



Summary Report
of the
Yorkville Raymond
Drainage District
Village of Union Grove
Assessment Report
May 18, 2026



Nielsen Madsen + Barber
CIVIL ENGINEERS AND LAND SURVEYORS



INTRODUCTION

The following report was prepared by Nielsen Madsen + Barber, at the request of the Racine County Board of Drainage Commissioners on behalf of the Yorkville Raymond Drainage District. The purpose of this report is to levy an assessment against the Village of Union Grove for the maintenance costs that are attributable to the Village per Wisconsin Statute § 88.64.

Nielsen Madsen + Barber (NMB) is a full-service consulting civil engineering and land surveying firm founded in 1954 providing decades of planning, surveying, engineering and management services to public and private clients throughout Wisconsin and northern Illinois. With four Department of Agriculture, Trade and Consumer Protection (DATCP) approved drainage engineers on staff, NMB has provided engineering, management and drainage expertise to the Racine County Board of Drainage Commissioners (Board) since 2010.

The Yorkville Raymond Drainage District (District) lies within the Root River watershed in Racine County, Wisconsin. Prior to widespread agricultural settlement in the nineteenth century, large portions of the area consisted of wetlands, muck soils, and poorly drained lowlands associated with the Root River and its tributaries. These conditions limited early farming and transportation. As settlement increased, landowners installed field ditches and subsurface tiles to make the land arable, a common practice across Wisconsin's agricultural regions.

Drainage districts are legally established areas created to facilitate the systematic removal of excess surface and subsurface water from agricultural lands and other properties. These districts are formed under state law to improve land usability, enhance agricultural productivity, and reduce the impacts of flooding and poor soil drainage. The overall objective is to provide a coordinated and equitable approach to land drainage that supports agricultural viability and land stewardship.



Flooding North of 58th Road

Elevated water tables and prolonged saturation have several negative impacts on soil conditions and crop performance. Saturated soils reduce oxygen availability in the root zone, impairing root respiration and limiting plant growth. Saturation also increases susceptibility to root diseases, reduces nutrient uptake, and diminishes soil strength, which affects field trafficability and timing of agricultural operations.

During storm events, elevated tailwater conditions can partially or fully submerge the tile system. When this occurs, the system transitions from gravity flow to partially pressurized flow, reducing its capacity to accept inflow from surrounding soils. This results in delayed drainage response, increased temporary storage of water within the soil profile, and prolonged saturation following rainfall events.

The images below are an example of a submerged tile preventing a timely drawdown of surface water from the adjacent agricultural field. The tile can be seen in the west embankment during low flow conditions. When this tile becomes submerged during high flow conditions, it reduces the performance of the tile resulting in prolonged standing water and soil saturation.



**Low Flow Condition
3 Mile Road Looking North**



**High Flow Condition
3 Mile Road Looking North**

The goal of farm drainage facilities such as drains (canals, ditches, creeks, laterals and branches) and tiles are to provide a drawdown of the surface water and elevated water table within 24 – 48 hours. Maintaining a healthy drainage system is critical to the mission of a farm drainage district.

Drainage districts operate under the supervision of the county drainage board and must comply with statutory requirements governing their establishment, modification, and long-term management. County drainage boards function as the governing authority responsible for administering drainage districts within their jurisdiction. County drainage boards act on behalf of the public interest by balancing agricultural drainage needs and landowner concerns.

In 1905, landowners petitioned the Racine County Circuit Court to establish a formal drainage district to improve drainage along a branch of the Root River in the Yorkville and Raymond

area. The lowland had a natural branch of the Root River system when it was dredged and straightened into a farm drainage ditch now known as the West Branch Root River (WBRR) Canal shortly after the District's creation circa 1905.

**DECISION IN
DRAINAGE SUIT**

**Judge Belden Declares all Legal
Requirements Are Met
in The Petition.**

**SIGNED BY MORE THAN
HALF OF THE OWNERS**

**Court Has Full Jurisdiction in Matter
—The Five Questions For
Future Hearing Fully
Outlined.**

A decision was filed in the circuit court this morning in the matter of the Yorkville and Raymond drainage district. More than one hundred and fifty farmers in the towns of Yorkville and Raymond are interested in this suit. It means if successful that a drain ten miles long, will be dug through the towns named; that it will result in the promotion of health of the community and redeem perhaps 2,500 acres of swamp lands. When application was made for the appointment of commissioners there was objection and some signers asked to withdraw their names. On account of the interest taken by both the farmers and citizens of the county the decision is given in full, as follows:

State of Wisconsin.—Circuit Court: Racine County.

In the matter of the Yorkville and Raymond Drainage District.

April A. D. 1905 term of said court, and on the 29th day of June and the 7th day of July, A. D. 1905, Kearney, Thompson & Myers appearing for the petitioners, and Storms & Fish, L. H. Rohr, D. H. Flett and Max W. Heek for the remonstrants, John H. Liegier and C. C. Gittings guardians ad litem for the infants interested in the premises affected by this proceeding, and the court having heard and considered the evidence and proofs offered and filed herein, the arguments of counsel, and being fully advised in the premises, now here finds as

MATTERS OF FACT.

First: That the petition filed herein on the 28th day of April, A. D. 1905 is signed by the owners of more than one-half in area of the lands within the boundaries of said drainage district therein described, to be reclaimed and benefited, as required by law.

Second: That all of said owners, except C. W. Stallman, who is the owner of an undivided one-third of parcel number thirty-three (33), which said parcel is not included in the computation upon which the first finding is based, who signed said petition, are of lawful age and adult owners of the lands and premises described in the said petition opposite to and in connection with the name of each.

Third: That said petition contains all of the allegations and averments required by law to be contained therein.

Fourth: That said petition in all respects is in compliance with law and is sufficient to confer upon the court jurisdiction of the subject matter of said proceeding.

Fifth: That the withdrawal of Gomer Roberts, one of said petitioners, in no manner affects the jurisdiction of the court over the subject matter of said proceeding or the sufficiency of said petition.

Sixth: That due notice of the time and place of hearing was served, published, posted and given all of the parties and persons interested as required by law.

And the court finds and concludes as conclusions of law.

That the court has jurisdiction of the subject matter of said proceeding, and of the persons of the parties owning or interested in lands within the boundaries of said proposed drainage district.

Whereupon.

It is ordered, That the questions reserved for future hearing, argument and consideration at the next hearing of

said matter be (1) The necessity or utility of said work or any part thereof, (2) Whether said proposed ditch, drain and other work is necessary, (3), or will be useful for the drainage of the lands proposed to be drained thereby, and (4) whether the public health or welfare will be promoted by the construction thereof; and in event the court shall find and conclude favorably to the prayer of said petition (5) the court will hear the parties with reference to the appointment of commissioners.

Further ordered, That a copy of this order, and of the foregoing, be served upon all of the attorneys of the parties who have appeared herein, within ten days from date hereof.

Dated July 12th, A. D. 1905.

By the Court,
E. R. Belden,
Circuit Judge.

Racine Daily Journal Article dated July 12, 1905

YORKVILLE RAYMOND DRAINAGE DISTRICT

The District encompasses parts of two municipalities within Racine County: the Village of Yorkville and the Village of Raymond. The District contains 4,803 acres of land. The Village of Raymond contains 1,565 acres and the Village of Yorkville contains 3,238 acres of land within the District. The land within the District is predominantly agricultural with areas of low and medium-density residential development as well as isolated commercial and manufacturing parcels.

The drainage system within the District includes four (4) branch tiles and four (4) branch ditches all of which drain to the West Branch Root River. The branch ditches, and that portion of West Branch Root River that is within the District, add up to a total of 64,739 linear feet (lf) (12.26 miles) of drainage way. The WBRR Canal itself is 54,113 lf (10.25 miles). The four (4) branch tiles have a total length of 11,550 lf (2.19 miles).

BACKGROUND

The District is obligated, under Wisconsin Statute § 88.63, to maintain and repair District facilities. The cost of maintenance and repair is assessed based upon the benefits each parcel within the District receives per Wisconsin Statute § 88.23. Property owners within the District are assigned, in part, a proportionate “charge” based on the amount of runoff “generated” by their property which is equated to the benefit provided to the property by the operation and maintenance of the District.

A drainage board may also assess a municipality with territory upstream from any drain for any costs of enlarging or maintaining those District facilities that are attributable to increased water flow from land within the municipality in accordance with Wisconsin Statute § 88.64.

Historically, the District has entered into agreements with the Villages of Union Grove, Yorkville and Raymond to share the District costs with a 40-40-20 split, respectively. These agreements allowed the District and municipalities to avoid the expenses related to preparing and administering a formal assessment and focus more of the funds on actual maintenance of the District facilities. The most recent agreement expired on December 31, 2020. While the Villages of Yorkville and Raymond were willing to enter into a new agreement, the Village of Union Grove disagreed with the 40-40-20 split and refused to be a party to a new agreement under those terms. Without a new agreement, the Board had to proceed with a formal assessment to raise funds for ongoing maintenance of the District facilities.

In 2023, the Board levied a \$3.2 million assessment against the three municipalities over five years for the purpose of dredging the WBRR Canal to improve the hydraulics and restore the capacity within the farm drain due to sedimentation and scouring. The assessment was based on a Mapping and Benefits Assessment report prepared by NMB dated September 13, 2023. That report detailed the portion of the flow within the WBRR Canal attributable to each municipality and thus the responsibility of the maintenance costs. The report determined that the Villages of Union Grove, Yorkville and Raymond were responsible for 36.4%, 38.9% and 24.7%, respectively. The Village of Union Grove’s portion of the \$3.2 million assessment was \$1,164,800.

The Village challenged the assessment, arguing that the Board had failed to comply with the statutory requirements governing such assessments under Wisconsin Statute § 88.64. The statute requires that a drainage board obtain a detailed engineering report addressing specific technical elements, including the costs of restoring, enlarging, or maintaining the

drain and the extent to which increased flow from upstream municipalities contributes to those costs.

The Village filed for review of the Circuit Court seeking declaratory and injunctive relief. The Circuit Court affirmed the Board's assessment and the Village appealed to the Court of Appeals. The Court of Appeals in a 2-1 ruling determined that the engineering report relied upon by the Board did not satisfy the statutory requirements. The Court of Appeals found that the report failed to include required analyses specified in § 88.64(3), including identifying increases in flow since the drain was last constructed or enlarged.

Importantly, the Court of Appeals did not rule that an upstream municipality such as the Village of Union Grove can never be assessed for drainage maintenance costs. Instead, the decision clarified that such assessments are permissible if a drainage district strictly complies with the procedural and technical requirements of Wisconsin Statute § 88.64, including preparation of a complete engineering report demonstrating the increased upstream flows.

ASSESSING MUNICIPALITIES PER WISCONSIN STATUTE § 88.64

The Board seeks to levy an assessment against the Village of Union Grove for the maintenance costs attributable to the increased flows generated from the runoff and wastewater discharge produced by the Village. As outlined in Wisconsin Statute § 88.64, the following will address each of the previously identified criteria as it specifically relates to the Village of Union Grove.

The purpose of this analysis and report is to provide a comprehensive evaluation of the following requirements outlined in Wisconsin Statute § 88.64(3)(a)-(e):

- (a) The construction and costs that are necessary to restore the drain so that it conveys the same amount of water as when most recently constructed or enlarged.
- (b) The construction and costs that are necessary to enlarge the drain to convey the flow of water from any land in the drainage district or upstream from the drainage district that has been newly drained since the drain was most recently constructed or enlarged.
- (c) The construction and costs that are necessary to enlarge the drain to convey the flow of surface water from upstream sources that represents an increase in flow since the drain was most recently constructed or enlarged.
- (d) Of the increased flow identified in par. (c), the amount of that flow that is attributable to each municipality with territory in the watershed above the drain, based proportionally on all of the following:

1. The increased flow into the drain from impermeable surfaces such as roads, parking lots or roofs since the drain was most recently constructed or enlarged, whether or not the impermeable surfaces are within the watershed.
 2. The increased flow into the drain from the discharge of wastewater from a sewage treatment plant since the drain was most recently constructed or enlarged, whether or not the source of the wastewater is within the watershed.
- (e) The maintenance costs that are attributable to the flow of surface water from upstream sources that represents an increase in flow since the drain was most recently constructed or enlarged.

NMB requested clarification from Bart Chapman, the State Drainage Engineer with the Department of Agriculture, Trade and Consumer Protection (DATCP), regarding several terms and concepts outlined in Wisconsin Statute § 88.64. Mr. Chapman responded in a letter dated January 28, 2026 providing insight and clarification on the specific requirements of Wisconsin Statute § 88.64(3)(a)-(e). This letter is included in Appendix A of this report.

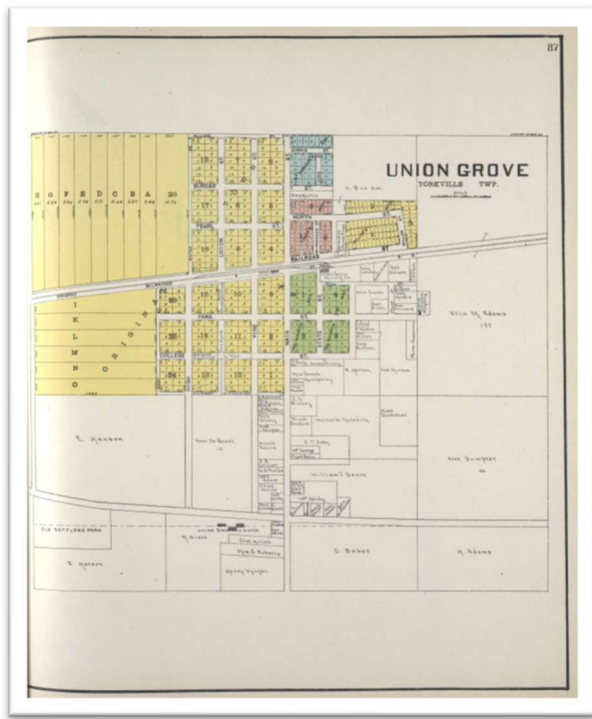
Method of Analysis

NMB used the United States Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS) Technical Release 55 (TR-55) "Urban Hydrology for Small Watersheds" method to determine the runoff tributary to the WBRR Canal from the Village of Union Grove. TR-55 is a procedure for estimating runoff and peak discharges in watersheds based on cover type, hydrologic soil groups, Time of Concentration (Tc) and rainfall distribution curves. The specific software is HydroCAD V10.20, as produced by HydroCAD Software Solutions, LLC.

The Plat Book of Racine and Kenosha Counties, Wisconsin, published by Hennessey & Company in 1908 included maps of Yorkville Township and Village of Union Grove. This date coincides with the same period that the drain was originally constructed. Therefore, for the purposes of this report, these plat maps have been used to determine the municipal boundary and land use conditions at the time the drain was constructed.



Plat Map of Yorkville Township, 1908



Plat Map of Union Grove, 1908

The land use from 1908 was determined from an aerial photograph from the US Department of Agriculture from August 13, 1937, titled 27-2458. Based on the plat map from 1908, the aerial image from 1937 was a good representation of the conditions in 1908 for those areas within the 1908 municipal boundary.



USDA Aerial Photo 27-2458 dated August 13, 1937

The current municipal boundary for the Village of Union Grove was determined by the Racine County Geographical Information System (GIS) database. The current conditions were determined by an aerial image dated 2025 published by Bing.

The soils within the area of analysis are predominately classified as a Type C hydrologic soil group; therefore, Class C was assumed for the entire analysis.

The cover type was broken down into four categories: Agricultural / Park / Open Space (APO), Commercial / Industrial / Municipal (CIM), High Density Residential (HDR) and Low Density Residential (LDR). The cover type and hydrologic soil group are used to determine the Runoff Curve Number (CN). NMB is proposing to use the Curve Number values as specified in TR-55 Table 2-2. The information relative to this report are listed in Appendix B of this report. The following Curve Numbers were used for each cover type:

- APO (CN 71)
- CIM (CN 92)*
- HDR (CN 81)
- LDR (CN 77)

* The CN is a composite of 91 & 94. A CN 81 was used for the Southern Wisconsin Center

The Tc was determined using the NRCS Lag Method for each of the five sub-basins. The NOAA Atlas 14 rainfall data for Racine County was used for the rainfall distribution curve. Specific routing conditions will be discussed later in this report.

88.64(3)(a) Costs to Restore the Drain to Original Condition

The construction and costs to restore the drain consists of two components: construction costs and soft costs. The 'soft costs' include items such as administrative, engineering, legal, permitting, construction observation and construction management.

The West Branch Root River has never been enlarged since its original construction as a District farm drain. In accordance with DATCP guidance, the approved District specifications should be considered the most recently constructed. A cost estimate was prepared to restore the West Branch Root River back to the approved specifications for the entire length of the drain within the District. That estimate was broken down into five (5) separate areas, identified as Contracts 1-5.

The estimated construction cost for each of the five (5) contracts are as follows:

88.64 (3) Construction Costs

Contract	Estimate
1	\$1,101,800
2	\$1,468,000
3	\$833,600
4	\$632,600
5	\$923,200
Soft Costs	\$220,000
Total	\$5,179,200

Total cost to restore the drain is \$5.179 million. That cost included 'soft costs' such as administrative, engineering, legal, inspection and management costs associated with the work. The cost estimate can be found in Appendix C of this report.

88.64(3)(b) Costs to Construct Conveyance of Newly Drained Areas

The term 'newly drained' is not defined in State Statute but is assumed to be the area of land that has been added to the Village of Union Grove since the original construction of the farm drainage system.

To determine the flow from 'newly drained' land within Union Grove, runoff was analyzed for the current municipal boundary along with current development conditions for the areas outside of the 1908 municipal boundary for the 10-year storm event using HydroCAD. The 1908 municipal boundary was determined by the previously referenced plat maps. The fully developed Canopy Hills residential development which is currently under construction was included in the current development conditions modelling. The areas were modelled based on the 'Method of Analysis' section of this report. The HydroCAD modelling details can be found in Appendix D and land use exhibits can be found in Appendix H of this report.

Based on that information, the 'newly drained' land generates a peak discharge of 360 cubic feet per second (cfs). That peak flow represents the capacity of the District drain that is filled by the 'newly drained' land within Union Grove. Based on the approved WBRR Canal cross section and average longitudinal slope from the upstream end of the District to the downstream end of the District, 360 cfs requires 154 square feet (sf) of area within the cross-section of the WBRR Canal. That equates to 308,645 cubic yards (cy) of excavated material to provide the capacity necessary to convey runoff from the 'newly drained' area within Union Grove.

$$154 \text{ sf} \times 54,113 \text{ linear feet (lf)} \rightarrow 8,333,402 \text{ cubic feet (cf)}$$

$$8,333,402 \text{ cf} \times (1 \text{ cy} / 27 \text{ sf}) \rightarrow 308,645 \text{ cy}$$

The estimated cost to excavate, place, shape and restore 308,645 cy of material is \$2,806,010. When construction contingencies are included that cost becomes \$3,507,512. The cost estimate can be found in Appendix A of this report.

88.64(3)(c) Costs to Construct Conveyance of Increased Flows

The increase in flow consists of two primary sources: 1) the increase in stormwater runoff due to development and the expansion of the Village of Union Groves corporate limits, and 2) the effluent from the UGWTP which discharges to the WBRR Canal.

Stormwater Runoff

To determine the increased flow from runoff within Union Grove, we first analyzed the runoff generated from the Village of Union Grove from when the drain was originally constructed which we have previously identified as some time shortly after 1905. This develops a baseline of flow attributable to Union Grove at the time the drain was originally constructed.

The Village of Union Grove produced a 10-year peak discharge of 86 cfs at the time of the original Drain construction. The HydroCAD modelling details can be found in Appendix D of this report.

The runoff was then analyzed using the current municipal boundary and current development conditions. The current municipal boundary was obtained from the Racine County GIS database. The current conditions were determined by an aerial image dated 2025 published by Bing plus the addition of the fully developed Canopy Hills development which is currently under construction.

Based on that information, Union Grove currently produces a peak discharge of 469 cfs for the 10-year storm. The HydroCAD modelling details can be found in Appendix D and land use exhibits can be in Appendix H of this report.

The increase in flow was determined by taking the difference in peak discharge between those two timeframes. Therefore, the increase in stormwater runoff to the WBRR Canal is 383 cfs.

$$469 \text{ cfs} - 86 \text{ cfs} = 383 \text{ cfs}$$

Based on the approved cross-section of the WBRR Canal and average longitudinal slope from the upstream end of the District to the downstream end of the district, 383 cfs requires 162 sf of area within the cross-section of the WBRR Canal. That equates to 324,678 cy of excavated material to provide the capacity necessary to convey the increase in runoff within Union Grove.

$$162 \text{ sf} \times 54,113 \text{ lf} \rightarrow 8,766,306 \text{ cf}$$

$$8,766,306 \text{ cf} \times (1 \text{ cy} / 27 \text{ sf}) \rightarrow 324,678 \text{ cy}$$

Union Grove Wastewater Treatment Plant

According to a WWTP Facilities Plan for the Village of Yorkville dated July 29, 2020, prepared by Short Elliot Hendrickson Inc., the Village of Union Grove constructed its first municipal sewage treatment plant in 1937 to serve the community's developing sanitary sewer system. The facility treated municipal wastewater from the Village prior to discharging effluent to the WBRR Canal, which remains the receiving water for the system today. The original plant provided treatment consistent with the standards of the era but had limited treatment capability and hydraulic capacity.

In 1979, the Village replaced the original facility with a new wastewater treatment plant. The replacement plant was constructed along the west side of 67th Drive right where it crosses the WBRR Canal. This facility is hereinafter referred to as the Union Grove Wastewater Treatment Plant (UGWTP). The UGWTP subsequently expanded in 1994 and further upgraded in 2002, increasing the plant's hydraulic capacity to approximately 2.0 million gallons per day (MGD).

Historically, the Southern Wisconsin Center, located in the Town of Dover east of Union Grove, operated its own on-site wastewater treatment plant serving the institutional campus and its residents. Regional wastewater planning completed by the Southeastern Wisconsin Regional Planning Commission (SEWRPC) determined that long-term water quality objectives would be better achieved by abandoning the Southern Wisconsin Center treatment plant and conveying wastewater from the campus to the Union Grove system. Following expansion of the UGWTP in the 1990s, sanitary flows from the Southern Wisconsin Center were connected to the Village sewer system and are now conveyed to the UGWTP.

The UGWTP relies on the WBRR Canal to release its effluent to a safe and reliable receiving waters. This effluent contributes to scour and sediment accumulation of the WBRR Canal and the need for ongoing maintenance within the drainage system.

Since the UGWTP did not exist when the District was created, all flow from the UGWTP is an increased flow. Annual treatment plant effluent discharges from 2016 through 2025 were provided to NMB by the Wisconsin Department of Natural Resources (WDNR) in emails dated February 5, 2021 and February 27, 2026. This information can be found in Appendix E of this report.

In order to calculate the capacity required to facilitate the discharge from the UGWTP, the maximum peak daily flow into the WBRR Canal for each year from 2016 through 2025 was determined. These values ranged from 2.46 million gallons per day (MGD) to 5.62 MGD. On average over the last ten (10) years, the UGWTP has reached a maximum discharge of 4.31 MGD of effluent into the WBRR Canal. The effluent flow rate of 4.31 MGD was converted to a peak discharge of 10.0 cfs using a Peaking Factor (PF) of 1.5 which is realistic for a high inflow/infiltration day.

$$Q_{\text{peakday}} \times \text{PF} = Q_{\text{peakhour}}$$

$$4.31 \text{ MGD} \times 1.5 \rightarrow 6.46 \text{ MGD}$$

$$6.46 \text{ MGD} \times (1,000,000 \text{ gallons} / \text{day}) \times (0.133681 \text{ cf} / \text{gallon}) \rightarrow 863,579 \text{ cf per day}$$

$$863,579 \text{ cf per day} \times (1 \text{ day} / 24 \text{ hours}) \times (1 \text{ hour} / 3600 \text{ seconds}) \rightarrow 10.0 \text{ cfs}$$

The peak discharge of 10.0 cfs requires 12.4 sf of area within the cross-section of the WBRR Canal. That equates to 24,852 cy of excavated material to provide the capacity necessary to convey the peak flows from the UGWTP.

$$12.4 \text{ sf} \times 54,113 \text{ lf} \rightarrow 671,001 \text{ cf}$$

$$671,001 \text{ cf} \times (1 \text{ cy} / 27 \text{ sf}) \rightarrow 24,852 \text{ cy}$$

The effluent from the UGWTP was also calculated in terms of total volume compared to the average annual precipitation from within the District boundary. Annual treatment plant effluent flows from 2016 through 2025 were analyzed with the data by the WDNR. The effluent data was averaged and resulted in 374.4 million gallons average annual effluent for the facility over that ten (10) year period.

The average annual precipitation for the District was determined using data from the U.S. Department of Commerce National Oceanic and Atmospheric Administration (NOAA) which maintains climate data including annual precipitation from stations across the country. One of NOAA's stations is located in the Village of Union Grove. Annual precipitation data from 1996 to 2025 for the Union Grove station was used to determine an average annual precipitation for the District. The resulting 30-year average annual precipitation was 34.51 inches.

The District contains 4,803 acres with an average runoff coefficient of 0.172. The product of the District area, the annual precipitation and the average runoff coefficient is the total average annual runoff. Per this calculation procedure, the average annual runoff is 773.4 million gallons within the Drainage District. When the average annual runoff is added to the 374.4 million gallons of effluent from the UGWTP, the total annual flow produced by the District is 1.148 billion gallons. The average annual effluent from the UGWTP is 32.62% of the total average annual flow produced from the District.

While the average daily effluent from 2016 through 2025 was 0.93 MGD, according to the Water Quality Management Plan for the Village of Union Grove prepared by Southeast Wisconsin Regional Planning Commission (SEWRPC), the UGWTP has the capacity to treat 2.0 MGD. It is likely that the consistent daily flows and peak discharges from this plant will increase as the Village continues to see development.

Dredging and re-sloping work often requires the drain to be free of water to allow for equipment to work within the banks. This is achieved by constructing bulkheads (dams)

within the drain and pumping the water out. Upstream flows are then detained within the available capacity of the drain upstream of the work. When the water approaches the top of the bank, it must be pumped downstream beyond the area of work. For these reasons, this work is generally performed during dry weather months (late summer) or during the winter to minimize the risk of heavy precipitation and the significant flow of water through the drain.

The constant flow generated by the UGWTP presents difficult challenges for maintenance of the WBRR Canal. The 0.93 MGD of effluent produced by the UGWTP on a daily basis must be accommodated during construction, which results in a higher cost of construction. Since the UGWTP is located upstream of the District's drain, this factor increases the construction cost for the entire length of the drain. Furthermore, this constant flow reduces the storage capacity available to mitigate rainfall events and cause the need to remove the bulkheads to allow water to pass through the work area when pumping can't keep up with the flows generated during a rainfall event. This adds significant cost and delay to the project.

Stormwater Runoff and Sanitary Combined Flows

The total increase in flow from Union Grove is determined by combining the peak flow of 383 cfs from stormwater runoff and the peak flow of 10.0 cfs from the UGWTP effluent (excluding any potential TFO) for a total of 393 cfs and 174.4 sf of cross-sectional area. These combined flows equate to 349,530 cy of capacity necessary to convey the increased flows from the Village of Union Grove.

$$174.4 \text{ sf} \times 54,113 \text{ lf} \rightarrow 9,437,307 \text{ cf}$$

$$9,437,307 \text{ cf} \times (1 \text{ cy} / 27 \text{ sf}) \rightarrow 349,530 \text{ cy}$$

The estimated cost to excavate, place, shape and restore 349,530 cy of material is \$3,133,090. When construction contingencies are included that cost becomes \$3,916,362. The cost estimate can be found in Appendix C of this report.

The highest rates of effluent from the UGWTP occur shortly after heavy rain events due to inflow & infiltration into the sanitary sewer collection system. In other words, the peak flow of effluent from the UGWTP to the WBRR Canal occurs during periods of heavy rainfall when the WBRR Canal is already at or beyond its capacity compounding the negative effects on the drain and surrounding areas.

On April 18, 2026, the UGWTP discharged 200,000 gallons of diluted wastewater over a 14-hour period in what is known as a Treatment Facility Overflow (TFO) due to elevated flows within the sanitary sewer system caused by heavy rain, according to a public notice published by the Village of Union Grove Utilities Department dated April 20, 2026. TFOs are not included in the effluent reporting data that was provided by the DNR, so these overflows are not included in the previous calculations but are additional discharges that the WBRR Canal must convey.

Immediately downstream of the UGWTP property, the WBRR canal flows under 67th Drive. Several times in the past decade including just recently in April of 2026, 67th Drive has been overtopped with flood water coming from the Village of Union Grove. Flooding occurs so often at this location that the Wisconsin Department of Transportation awarded the Village of Union Grove a Local Road Improvement Program grant to replace the culvert and reduce the roadway flooding. In the fall of 2026, Union Grove will be replacing the existing culvert with a new box culvert with nearly four times the flowable area. This is further evidence of the increased flows to the WBRR canal from the Village of Union Grove and the importance of having a reliable receiving waters to serve the Village's needs.



Flooding at 67th Drive



Flooding at 67th Drive

88.64(3)(d)(1) Increased Flows Due to Runoff

The increase in flow from impermeable surfaces is factored into the peak discharge from the runoff portion as determined in section 88.64(3)(c) of this report which determined a peak discharge of 383 cfs to the WBRR Canal.

88.64(3)(d)(2) Increased Flows Due to Sewage Treatment Plant Discharge

As previously stated in section 88.64(3)(c) of this report, all flow from the UGWTP is considered an increased flow since the plant did not exist when the District was created. The

increased sewage treatment plant flows were calculated in two manners. The 10-year average maximum yearly peak discharge of effluent from the UGWTP to the WBRR Canal is 10.0 cfs. The average annual volume of effluent from the UGWTP to the WBRR Canal is 374.4 million gallons.

88.64(3)(e) Maintenance Costs Attributable to Increased Flows

The costs associated with the current maintenance for the WBRR Canal are the same as the costs to restore the drain to original conditions as outlined in section 88.64(3)(a) of this report and determined to be \$5.179 million.

These maintenance costs include dredging of sediment at the bottom of the drain, excavating / filling & shaping the side slopes back to the District specifications, placing, shaping & restoring all excavated material and incidental items to complete the work.

Accumulated sediment within the WBRR Canal is the driving factor behind the significant maintenance needs and cost. Sediment is typically introduced through upstream erosion, agricultural runoff, bank instability, and stormwater transport. There are many factors that contribute to the accumulation of sediment.

While undeveloped lands can be a significant source of sediment, when the WBRR Canal was originally constructed, the dredged material was placed on the banks creating a barrier in most locations. Most agricultural fields along the WBRR Canal are drained away from the Canal and discharged internally through tile systems or grassed swales. The majority of sediment is from scouring of the Canal banks and upstream sources. Over time, this material deposits along the channel bed and side slopes, progressively altering the geometry and function of the conveyance system.



Deposits on the Inside and Scouring on the Outside

Sediment impacts the hydraulic performance and long-term stability. The most immediate effect of sediment accumulation is a reduction in the effective cross-sectional area of the channel. As the channel bed fills, the available flow area decreases and the wetted perimeter

increases in irregularity, resulting in higher hydraulic roughness. From a hydraulic standpoint, this reduces the conveyance capacity of the channel and increases water surface elevations for a given flow event. In practical terms, storm events that were previously contained within the banks may begin to overtop, and the level of service of the drainage system is diminished. This is particularly critical in farm drainage ditches such as the WBRR Canal, where even moderate storm events can result in nuisance flooding once capacity is reduced.

The hydraulic inefficiencies caused by sediment accumulation also produce backwater effects upstream. Elevated water surface profiles extend upstream of the impacted reach, slowing the drainage of connected systems such as subsurface agricultural tiles, roadside ditches, and storm sewer outfalls. This results in prolonged ponding and extended drawdown periods following precipitation events.

This also creates accelerated sedimentation. Lower velocities reduce the channel's ability to transport sediment, which leads to further deposition and additional reductions in capacity. Over time, this process can result in partial or complete channel infilling if maintenance is not performed.



Accumulated Sediment at 5 Mile Road



Accumulated Sediment at CTH A

The WBRR Canal was last dredged sometime between 1980 - 1986. Since that time, sediment has been re-accumulating within the canal. Sediment depths were measured within the Canal in March of 2018 and in March of 2026. On average, 2.45' of sediment has accumulated within the canal from the 1980's to 2018 which results in a rate of 0.84" per year over a 35-year period. On average, an additional 0.8' of sediment has accumulated in the past 8 years from 2018 to 2026 at a rate of 1.2" per year. That represents a 33% increase in sediment in the last 8 years. 3.25' of depth / capacity within has been lost due to sedimentation.

West Branch Root River Canal Sediment Depths

STA / LOCATION	SEDIMENT DEPTH MARCH 2018	SEDIMENT DEPTH MARCH 2026	CHANGE IN DEPTH
34+00 (5 Mile Road)	2.5'	4.0'	+1.5'
91+30 (CTH K)	3.0'	3.5'	+0.5'
146+68 (3 Mile Road)	1.5'	3.5'	+2.0'
211+90 (2 Mile Road)	3.5'	4.5'	+1.0'
262+30 (Hribar Dwy)	2.0'	3.5'	+1.5'
280+87 (50th Road)	2.5'	3.5'	+1.0'
310+21 (STH 20)	1.5'	1.0'	-0.5'
340+64 (CTH A)	2.0'	1.0'	-0.5'
410+79 (CTH C)	2.0'	3.0'	+1.0'
474+49 (58 th Road)	4.0'	5.0'	+1.0'
Average	2.45'	3.25'	+0.8'

The sediment depth analysis clearly illustrates the need for the currently proposed maintenance project and ongoing maintenance in the future. This report has outlined the significant increases in flow generated by the Village of Union Grove from stormwater runoff and the constant discharge from the UGWTP. These flows impact the entire system as they enter the Canal upstream of the District. The loss in capacity resulting from the increased flows from Union Grove impact the geometry and hydraulics that create more favorable conditions for sediment to accumulate within the Canal. These conditions have a significant negative impact on agricultural fields, contributing to sedimentation and diminishing the Canal's ability to improve land usability, enhance agricultural productivity, and reduce the impacts of flooding and poor soil drainage. The increased flow attributable to Union Grove represents the portion of maintenance costs attributable to Union Grove.

As previously calculated in this report, the UGWTP produces 32.62% of the flow generated by the District. Since all flows from the UGWTP are considered an increase, the UGWTP is responsible for 32.62% of the total maintenance costs.

The remaining 67.38% of the maintenance costs shall be split among the three municipalities based on the percentage of stormwater runoff. The drainage areas were modelled based on the 'Method of Analysis' section of this report. The overall watershed boundary was broken up into 5 sub-basins with the downstream end of the sub-basin at: the upstream limits of the District facilities (Area 1), CTH C (Area 2), STH 20 (Area 3), Two Mile Road (Area 4) and CTH K (Area 5). These sub-basins were further broken down into each of the three municipalities. Since Union Grove can only be assessed for the increase in flow since the District was created, the acreage used for Union Grove is the increase in Land Use from 1908 to 2025. An overall watershed boundary exhibit can be found in Appendix F of this report.

Watershed Area per Municipality

	Area 1 (ac)	Area 2 (ac)	Area 3 (ac)	Area 4 (ac)	Area 5 (ac)	Total (ac)	(%)
Raymond	0	0	0	3,784	5,868	9,652	38.8
Union Grove	688*	0	0	0	0	688	2.8
Yorkville	1,865	2,759	3,718	6,198	0	14,540	58.4
Total	2,553	2,759	3,718	9,982	5,868	24,880	100

* This area represents the increase in land use from 1908 to 2025

A breakdown of land use by municipality is shown below.

Land Cover by Municipality

	APO (ac)	CIM (ac)	HDR (ac)	LDR (ac)	Total (ac)
Raymond	7,241	42	9	2,360	9,652
Union Grove	188*	145*	350*	5*	688
Yorkville	10,924	771	36	2,809	14,540
Total	18,353	958	395	5,174	24,880

* This area represents the increase in land use from 1908 to 2025

The peak discharge for the 10-year, 24-hour rainfall event for each sub-basin are as follows:

Calculated Runoff per Municipality

	Area 1 (ac)	Area 2 (ac)	Area 3 (ac)	Area 4 (ac)	Area 5 (ac)	Total (ac)	(%)
Raymond	0	0	0	1,481	1,651	3,132	36.9
Union Grove	405*	0	0	0	0	405	4.8
Yorkville	557	726	1,233	2,426	0	4,942	52.3
Total	962	726	1,233	3,907	1,651	8,479	100

* This peak discharge represents the increase in runoff from 1908 to 2025

The increase in stormwater runoff to the WBRR Canal generated by Union Grove from 1908 to 2025 is 4.8% of the runoff generated by the watershed of the WBRR Canal. Therefore, Union Grove is responsible for 4.8% of the remaining maintenance costs which equates to 3.23% (4.8% of 67.38% is 3.23%).

The combined responsibility of maintenance costs for the Village of Union Grove is 35.8% (32.62% + 3.23%).

VILLAGE OF UNION GROVE ASSESSMENT

Located in the center of Racine County, with access to two main highways, the Village of Union Grove has a rural-urban blend. Its population – currently about 5500 - has grown 15% over the last 6 years. New residential developments, including Canopy Hills, portend further population increase. While it has a vibrant business community, the Village’s 2026 Downtown

Redevelopment Plan will likely attract even more new ventures. The Village of Union Grove's accelerated growth reinforces the increased flow detailed in this report.

While this report addresses each section of Wisconsin Statute § 88.64(3)(a)–(e), not all sections are relevant to the currently planned maintenance project that this assessment was prepared for. Wisconsin Statute § 88.64(3)(a) – Costs to Restore the Drain to Original Construction is essentially the scope of the currently planned maintenance project for the WBRR Canal and the costs determined in that section are the same as the construction cost estimate of the project. Wisconsin Statute § 88.64(3)(e) utilizes the costs of Wisconsin Statute § 88.64(3)(a) but provides a detailed explanation of the costs due to increased flows from the Village of Union Grove. While included in the report, Wisconsin Statute § 88.64(3)(b)–(d) are not applicable to this particular assessment.

Based on the allocation above, the Village of Union Grove is responsible for 35.8% of any maintenance cost associated with the WBRR Canal. The construction costs associated with the currently proposed maintenance project were outlined in the Wisconsin Statute § 88.64(3)(a) section of this report and totaled \$5,179,200. Additional maintenance projects included in this assessment include spraying and mowing of the corridor. When these components along with the associated operational costs are included, the total cost of the project is \$5,374,000. The Village of Union Grove's portion of those maintenance costs are \$1,923,892 (35.8%).

$$\$5,179,200 + \$45,900 \text{ (spraying)} + \$28,900 \text{ (mowing)} = \$5,374,000$$

$$\$5,374,000 \times 35.8\% = \$1,923,892$$

Maintenance projects are not possible without an assessment to raise the funds for the project. Therefore, the overall maintenance costs also include the administrative, legal and engineering costs associated with the assessment efforts. Since the Villages of Raymond and Yorkville are already paying for their share of the previous 2023 assessment costs, the Village of Union Grove will now be assessed for their portion (35.8%) of the 2023 assessment costs which totals \$25,593. The total cost for this re-assessment is budgeted to be \$138,000 for which the Village of Union Grove will be assessed the entire amount as they are the sole recipient of the assessment.

$$\$1,923,892 + \$25,593 + \$138,000 = \$2,087,485$$

Based on this report and in accordance with Wisconsin Statute § 88.64, it is recommended that \$2,087,485 be assessed to the Village of Union Grove for the increased flow discharged to the WBRR Canal. A summary of maintenance and associated costs can be found in Appendix G of this report.

APPENDIX A
DATCP CORRESPONDENCE



State of Wisconsin
Governor Tony Evers

Department of Agriculture, Trade and Consumer Protection
Secretary Randy Romanski

January 28, 2026

VIA EMAIL

Jason Christensen, P.E,
Nielsen Madsen & Barber
1458 Horizon Blvd, Suite 200
Racine, WI 53406

Re: Racine County Board of Drainage Commissioners inquiry regarding drainage of lands under ch. 88, Wis. Stats.

Mr. Christensen,

The Department received your questions shared on behalf of the Racine County Board of Drainage Commissioners regarding drainage law under ch. 88, Wis. Stats. Pursuant to s. 88.11, Wis. Stats., the state drainage engineer shall provide technical assistance to improve district operations at the request of a drainage board. The following is provided for informational purposes only, does not constitute legal advice, and is not a substitute for obtaining advice from legal counsel. Consultation with legal counsel may be necessary for further evaluation and confirmation that the law is applied correctly.

88.64(2)

- a. This section identifies a series of scenarios for which costs are to be determined; however, there is no explanation of how various costs factor into a final cost to be assessed to an upstream municipality. It has been established by the courts that all subsections of 88.64(3)(a-e) shall be addressed in the report. If a maintenance project is being proposed, should the value of the assessment be the cost determined in section 88.64(3)(e) only? In other words, even those costs were calculated per sections 88.64(3)(a-d), those costs don't apply and are not factored into the assessment for a maintenance project?

DATCP Response

Section 88.64(2), Wis. Stat., provides that a "drainage board may assess a municipality with territory upstream from any drain for any costs of enlarging or maintaining the drain that are attributable to increased water flow from land within the municipality." As stated, to determine what costs are attributable to the municipality, all subsections of s. 88.64(3)(a-e), Wis. Stats., shall be addressed in the report required under s. 88.64(3), Wis. Stats., including both the maintenance costs attributable to the increase in flow from upstream sources and the costs associated with the enlargement of the drain that is attributable to increased flows from the municipality.

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There are 2 flow regimes that could be addressed to estimate the capacity of the drain to accommodate the baseflow and the 10-yr, 24-hr storm. The baseflow is increased by the daily discharges into the drain from the WWTP and the 10-yr, 24-hr storm would affect the drain by the daily flow from the WWTP and the stormwater flow attributable to the Village of Union Grove.

From an engineering principles and practice standpoint, an evaluation of the capacity of the drain to convey each of these flows would address the need to “enlarge” the drain.

1. Baseflow – to retain the water surface elevation (WSE) of the drain, what would the cross-sectional area (A) need to be to maintain the current WSE.
2. 10-yr, 24-hr storm – like the baseflow analysis, with the understanding that the discharge overtops the banks in several locations. Perhaps there are cross-section locations along the channel that this analysis could be applied. The assumption would be that the WSE at the locations where this design storm is contained within the active channel would result in an adjustment to the cross-sectional area and the excavation volume would be applied to the entire channel length.
3. The results of the analysis could be used to estimate a cost associated with the excavation needed to maintain the WSE by multiplying the cross-sectional area by the channel length and applying a current market cost estimate per cubic yard.

88.64(3)(a)

- b. Does the term ‘restore’ include removal of sediment to original bottom of the drain?

Does the term ‘restore’ include reconstruction of banks to original shape and size?

DATCP Response

In accordance with ATCP § 48.01(21), Wis. Admin. Code, “restoration” or “restoration project” means dredging or other operations designed to bring the cross-section, grade profile or alignment of a district drain into closer conformity with the formally established cross-section, grade profile or alignment of that district drain.

- c. Does the phrase ‘most recently constructed or enlarged’ refer to the original construction of the drain if the drain has never been enlarged?

Does removal of sediment from the bottom of the drain constitute an enlargement?

DATCP Response

The Yorkville-Raymond Drainage District was established by court order in 1943. This is the date that the drain was most recently constructed. In accordance with s. 88.64(1)(a), Wis. Stats., “enlarge” means to increase the capacity of a drain to convey water, including adding facilities such as pumps or lift stations, by performing necessary construction. The Department is unaware of any projects that enlarged the District drain.

The Department approved the Yorkville-Raymond Drainage District specifications on October 17, 2003. This

approval constitutes the formally established cross-section, grade profile and alignment for district drains. The specifications identify the dimensions of the district drains. Removal of sediment from the bottom of the drain in accordance with the grade profile elevations and cross-section dimensions represents the limit for drain maintenance. If the drainage board intends to go beyond the formally established limits, then a modification to the specifications is required under § ATCP 48.21, Wis. Admin. Code.

88.64(3)(b)

- d. Can you provide a definition for the phrase ‘upstream from the drainage district’?

Does this mean any land that drains to the district drain, any area that drains to the district drain that is outside of the current district boundary, or only the area upstream of the headwaters of a district drain?

DATCP Response

Upstream from the district drain fundamentally encompasses all land upstream that discharges to the district drain. In the case for assessing a municipality for any costs of enlarging or maintaining the drain which has territory upstream from any drain, the land upstream includes the increased water flow attributable from land within the municipality. *See s. 88.64(2).*

- e. Can you provide a definition for the phrase ‘newly drained’?

Does this mean new improvements within the drainage area or new drains or tiles draining new land?

DATCP Response

The Yorkville-Raymond Drainage District was established by court order in 1943. The increased water flow attributable from land within a municipality would be sources of water that have been incurred since the date the drain was constructed. *See s. 88.64(3)(b).* There are multiple sources that may be considered ‘newly drained’ including increased impermeable surfaces, establishment of storm water outlets, and direct discharges like the outlet of storm water detention basins or a WWTP.

88.64(3)(c)

- f. Does the phrase ‘surface water’ refer to any rainwater runoff including overland or via storm sewers?
- g. Can you provide a definition for the phrase ‘upstream source’?

Does upstream mean any land that drains to the district drain, any area that drains to the district drain that is outside of the current district boundary, or only the area upstream of the headwaters of a district drain?

Does this mean new improvements within the drainage area or new drains or tiles draining new land?

DATCP Response

See previous discussion.

88.64(3)(d)

h. Can you provide a definition for the phrase ‘watershed above the drain’?

Does this mean any land that drains to the district drain, any area that drains to the district drain that is outside of the current district boundary, or only the area upstream of the headwaters of a district drain?

DATCP Response

See previous discussion.

88.64(3)(d)(1)

i. Does the phrase ‘impermeable surfaces such as roads, parking lots or roofs’ mean that all pervious surfaces should be ignored from this calculation?

Can you clarify how you could have flow into the drain from surfaces that are not within the watershed?

DATCP Response

If water originates in a watershed and is transferred to another watershed, then this basin transfer could be considered increased water flow that is attributable to the municipality contemplated under s. 88.64(3)(d)1. A common example would be water that is captured in a storage facility and is transferred to a different watershed via a pump station.

If you have any questions regarding this letter, please feel free to call me at (608) 224-4608 or you can email me at Barton.Chapman@Wisconsin.gov.

Sincerely,

Barton T. Chapman, P.E.
State Drainage Engineer

cc: Alan Jaspersen, Racine County Board of Drainage Commissioners Chairperson (via email)
Mark Hinkston, Racine County Board of Drainage Commissioners Attorney (via email)
Matt Woodrow, P.E., Conservation Engineering Section Manager, DATCP (via email)

APPENDIX B
TR-55 RUNOFF CURVE NUMBERS

Table 2-2a Runoff curve numbers for urban areas ^{1/}

Cover description	Average percent impervious area ^{2/}	Curve numbers for hydrologic soil group			
		A	B	C	D
<i>Fully developed urban areas (vegetation established)</i>					
Open space (lawns, parks, golf courses, cemeteries, etc.) ^{3/} :					
Poor condition (grass cover < 50%)		68	79	86	89
Fair condition (grass cover 50% to 75%)		49	69	79	84
Good condition (grass cover > 75%)		39	61	74	80
Impervious areas:					
Paved parking lots, roofs, driveways, etc. (excluding right-of-way)		98	98	98	98
Streets and roads:					
Paved; curbs and storm sewers (excluding right-of-way)		98	98	98	98
Paved; open ditches (including right-of-way)		83	89	92	93
Gravel (including right-of-way)		76	85	89	91
Dirt (including right-of-way)		72	82	87	89
Western desert urban areas:					
Natural desert landscaping (pervious areas only) ^{4/}		63	77	85	88
Artificial desert landscaping (impervious weed barrier, desert shrub with 1- to 2-inch sand or gravel mulch and basin borders)		96	96	96	96
Urban districts:					
Commercial and business	85	89	92	94	95
Industrial	72	81	88	91	93
Residential districts by average lot size:					
1/8 acre or less (town houses)	65	77	85	90	92
1/4 acre	38	61	75	83	87
1/3 acre	30	57	72	81	86
1/2 acre	25	54	70	80	85
1 acre	20	51	68	79	84
2 acres	12	46	65	77	82

Table 2-2c Runoff curve numbers for other agricultural lands ^{1/}

Cover description	Hydrologic condition	Curve numbers for hydrologic soil group			
		A	B	C	D
Pasture, grassland, or range—continuous forage for grazing. ^{2/}	Poor	68	79	86	89
	Fair	49	69	79	84
	Good	39	61	74	80
Meadow—continuous grass, protected from grazing and generally mowed for hay.	—	30	58	71	78
Brush—brush-weed-grass mixture with brush the major element. ^{3/}	Poor	48	67	77	83
	Fair	35	56	70	77
	Good	30 ^{4/}	48	65	73
Woods—grass combination (orchard or tree farm). ^{5/}	Poor	57	73	82	86
	Fair	43	65	76	82
	Good	32	58	72	79
Woods. ^{6/}	Poor	45	66	77	83
	Fair	36	60	73	79
	Good	30 ^{4/}	55	70	77

APPENDIX C
CONSTRUCTION COST ESTIMATES

Yorkville/ Raymond District
Proposed WBRR Dredging Project Budget Costs

88.64(3)(a)

4/14/2026

Contract 1 - West Branch of Root River

Station 0+00 (North Terminus) thru

Station 91+30 (CTH K - 4 Mile Rd)

	Quantity	Unit	Unit Cost	Total
Mechanical Dredging - Canal Bottom	9,130	LF	\$ 20.70	\$ 188,991.00
Restoration - Berm Spoils (Seed, Fertilizer, Mulch)	92,000	SY	\$ 1.00	\$ 92,000.00
Miscellaneous Canal Bank Debrushing	1	LS	\$ 5,000.00	\$ 5,000.00
Canal Side Slope Grading	31,300	CY	\$ 5.00	\$ 156,500.00
Canal Side Slope Erosion Mat (Class 2, Type A)	30,000	SY	\$ 7.00	\$ 210,000.00
Canal Side Slope Erosion Mat (Class 1, Type A)	43,800	SY	\$ 3.00	\$ 131,400.00
Canal Side Slope - Restoration (Seed & Fertilizer)	73,800	SY	\$ 0.50	\$ 36,900.00
Reimbursement for Crop Loss Due to Construction	7	AC	\$ 250.00	\$ 1,835.00
Reconnect Existing 4" Tile with 10 LF - 6" PVC & Rodent Guard	1	EA	\$ 400.00	\$ 400.00
Reconnect Existing 12" Tile with 10 LF - 15" PVC & Rodent Guard	1	EA	\$ 600.00	\$ 600.00
Tile Discharge Slope Reinforcement Mat (2 EA)	30	SY	\$ 125.00	\$ 3,750.00
Heavy Duty Rip Rap for Culvert Discharge (1 EA)	50	SY	\$ 125.00	\$ 6,250.00
Canal Draw Down and Bypass Pumping	1	LS	\$ 25,000.00	\$ 25,000.00
Remove & Install Main Stone Weir @ Sta. 0+00	1	EA	\$ 6,800.00	\$ 6,800.00
Remove & Install Main Cofferdam @ Sta. 14+00	1	EA	\$ 4,830.00	\$ 4,830.00
Remove & Install Temporary Cofferdams @ Stations 1+47, 72+00, 75+87 and 91+30	4	EA	\$ 2,800.00	\$ 11,200.00

Sub Total **\$881,456.00**
25% Contingencies **\$220,364.00**
TOTAL **\$1,101,820.00**

**Contract 2 - West Branch of Root River
Station 91+30 (CTH K - 4 Mile Rd) thru
Station 211+90 (2 Mile Road)**

	Quantity	Unit	Unit Cost	Total
Mechanical Dredging - Canal Bottom	12,060	LF	\$ 20.70	\$ 249,642.00
Restoration - Berm Spoils	88,600	SY	\$ 0.90	\$ 79,740.00
Miscellaneous Canal Bank Debrushing	1	LS	\$ 5,000.00	\$ 5,000.00
Debrushing East Bank (Sta 91+30 - 10+30)	1.30	AC	\$ 10,000.00	\$ 13,000.00
Debrushing West Bank (Sta 91+30 - 13+30)	1.20	AC	\$ 10,000.00	\$ 12,000.00
Canal Side Slope Grading	18,800	CY	\$ 5.00	\$ 94,000.00
Canal Side Slope Erosion Mat (Class 2, Type A)	57,000	SY	\$ 7.00	\$ 399,000.00
Canal Side Slope Erosion Mat (Class 1, Type A)	58,600	SY	\$ 3.00	\$ 175,800.00
Canal Side Slope - Restoration (Seed & Fertilizer)	115,600	SY	\$ 0.50	\$ 57,800.00
Reimbursement for Crop Loss Due to Construction	19	AC	\$ 250.00	\$ 4,775.00
Reconnect Existing 6" Tile with 10 LF - 8" PVC & Rodent Guard	3	EA	\$ 450.00	\$ 1,350.00
Reconnect Existing 8" Tile with 10 LF - 10" PVC & Rodent Guard	1	EA	\$ 500.00	\$ 500.00
Reconnect Existing 15" Tile with 10 LF - 18" PVC & Rodent Guard	1	EA	\$ 650.00	\$ 650.00
Reconnect Existing 18" Tile with 10 LF - 21" PVC & Rodent Guard	1	EA	\$ 700.00	\$ 700.00
Reconnect Existing 21" Tile with 10 LF - 24" PVC & Rodent Guard	1	EA	\$ 750.00	\$ 750.00
Reconnect Existing 24" Tile with 10 LF - 30" PVC & Rodent Guard	2	EA	\$ 800.00	\$ 1,600.00
Tile Discharge Slope Reinforcement Mat (9 EA)	135	SY	\$ 125.00	\$ 16,875.00
Heavy Duty Rip Rap for Culvert Discharge (4 EA)	200	SY	\$ 125.00	\$ 25,000.00
Canal Draw Down and Bypass Pumping	1	LS	\$ 25,000.00	\$ 25,000.00
Remove & Install Temporary Cofferdam @ Stations 109+00, 138+00, 146+00 and 211+90	4	EA	\$ 2,800.00	\$ 11,200.00

Sub Total **\$1,174,382.00**
25% Contingencies **\$293,595.50**
TOTAL **\$1,467,977.50**

**Contract 3 - West Branch of Root River
Station 211+90 (2 Mile Road) thru
Station 310+21 (Washington Avenue - STH 20)**

	Quantity	Unit	Unit Cost	Total
Mechanical Dredging - Canal Bottom	9,831	LF	\$ 20.70	\$ 203,501.70
Restoration - Berm Spoils	81,750	SY	\$ 0.90	\$ 73,575.00
Miscellaneous Canal Bank Debrushing	1	LS	\$ 5,000.00	\$ 5,000.00
Debrushing East Bank (Sta 254+00 - 267+00)	1.20	AC	\$ 10,000.00	\$ 12,000.00
Debrushing West Bank (Sta 281+00 - 295+00)	1.00	AC	\$ 10,000.00	\$ 10,000.00
Debrushing East Bank (Sta 296+00 - 309+00)	1.80	AC	\$ 10,000.00	\$ 18,000.00
Debrushing West Bank (Sta 305+00 - 309+00)	0.30	AC	\$ 10,000.00	\$ 3,000.00
Canal Side Slope Grading	11,400	CY	\$ 5.00	\$ 57,000.00
Canal Side Slope Erosion Mat (Class 2, Type A)	24,900	SY	\$ 7.00	\$ 174,300.00
Canal Side Slope Erosion Mat (Class 1, Type A)	9,800	SY	\$ 3.00	\$ 29,400.00
Canal Side Slope - Restoration (Seed & Fertilizer)	34,700	SY	\$ 0.50	\$ 17,350.00
Reimbursement for Crop Loss Due to Construction	10	AC	\$ 250.00	\$ 2,500.00
Reconnect Existing 6" Tile with 10 LF - 8" PVC & Rodent Guard	1	EA	\$ 450.00	\$ 450.00
Reconnect Existing 12" Tile with 10 LF - 15" PVC & Rodent Guard	1	EA	\$ 600.00	\$ 600.00
Reconnect Existing 15" Tile with 10 LF - 18" PVC & Rodent Guard	1	EA	\$ 650.00	\$ 650.00
Reconnect Existing 18" Tile with 10 LF - 21" PVC & Rodent Guard	1	EA	\$ 700.00	\$ 700.00
Reconnect Existing 21" Tile with 10 LF - 24" PVC & Rodent Guard	1	EA	\$ 750.00	\$ 750.00
Tile Discharge Slope Reinforcement Mat (5 EA)	75	SY	\$ 125.00	\$ 9,375.00
Heavy Duty Rip Rap for Culvert Discharge (2 EA)	100	SY	\$ 125.00	\$ 12,500.00
Canal Draw Down and Bypass Pumping	1	LS	\$ 25,000.00	\$ 25,000.00
Remove & Install Temporary Cofferdam @ Stations 242+00, 279+50, 295+50 and 310+00	4	EA	\$ 2,800.00	\$ 11,200.00

Sub Total	\$666,851.70
25% Contingencies	\$166,712.93
TOTAL	\$833,564.63

Contract 4 - West Branch of Root River
Station 310+21 (STH 20 - Washington Avenue) thru
Station 410+79 (CTH C - Spring Street)

	Quantity	Unit	Unit Cost	Total
Mechanical Dredging - Canal Bottom	10,058	LF	\$ 20.70	\$ 208,200.60
Restoration - Banks	45,500	SY	\$ 0.90	\$ 40,950.00
Miscellaneous Canal Bank Debrushing	1	LS	\$ 5,000.00	\$ 5,000.00
Canal Side Slope Grading	11,000	CY	\$ 5.00	\$ 55,000.00
Canal Side Slope Erosion Mat (Class 2, Type A)	11,300	SY	\$ 7.00	\$ 79,100.00
Canal Side Slope Erosion Mat (Class 1, Type A)	14,900	SY	\$ 3.00	\$ 44,700.00
Canal Side Slope - Restoration (Seed & Fertilizer)	26,200	SY	\$ 0.50	\$ 13,100.00
Reimbursement for Crop Loss Due to Construction	17	AC	\$ 250.00	\$ 4,362.50
Reconnect Existing 10" Tile with 10 LF - 15" PVC & Rodent Guard	1	EA	\$ 400.00	\$ 400.00
Reconnect Existing 12" Tile with 10 LF - 15" PVC & Rodent Guard	2	EA	\$ 600.00	\$ 1,200.00
Reconnect Existing 15" Tile with 10 LF - 18" PVC & Rodent Guard	1	EA	\$ 650.00	\$ 650.00
Tile Discharge Slope Reinforcement Mat (4 EA)	60	SY	\$ 125.00	\$ 7,500.00
Heavy Duty Rip Rap for Culvert Discharge (2 EA)	100	SY	\$ 125.00	\$ 12,500.00
Canal Draw Down and Bypass Pumping	1	LS	\$ 25,000.00	\$ 25,000.00
Remove & Install Temporary Cofferdam @ Station 340+60, 399+70 and 410+00	3	EA	\$ 2,800.00	\$ 8,400.00

Sub Total **\$506,063.10**
25% Contingencies **\$126,515.78**
TOTAL **\$632,578.88**

**Contract 5 - West Branch of Root River
Station 410+79 (CTH C - Spring Street) thru
Station 541+13 (South Terminus)**

	Quantity	Unit	Unit Cost	Total
Mechanical Dredging - Canal Bottom	13,034	LF	\$ 20.70	\$ 269,803.80
Restoration - Banks	59,000	SY	\$ 0.90	\$ 53,100.00
Miscellaneous Canal Bank Debrushing	1	LS	\$ 5,000.00	\$ 5,000.00
Canal Side Slope Grading	11,900	CY	\$ 5.00	\$ 59,500.00
Canal Side Slope Erosion Mat (Class 2, Type A)	10,000	SY	\$ 7.00	\$ 70,000.00
Canal Side Slope Erosion Mat (Class 1, Type A)	54,300	SY	\$ 3.00	\$ 162,900.00
Canal Side Slope - Restoration (Seed & Fertilizer)	64,300	SY	\$ 0.50	\$ 32,150.00
Reimbursement for Crop Loss Due to Construction	24	AC	\$ 250.00	\$ 5,970.00
Reconnect Existing 6" Tile with 10 LF - 8" PVC & Rodent Guard	1	EA	\$ 450.00	\$ 450.00
Reconnect Existing 8" Tile with 10 LF - 10" PVC & Rodent Guard	4	EA	\$ 500.00	\$ 2,000.00
Reconnect Existing 10" Tile with 10 LF - 15" PVC & Rodent Guard	2	EA	\$ 400.00	\$ 800.00
Reconnect Existing 15" Tile with 10 LF - 18" PVC & Rodent Guard	1	EA	\$ 650.00	\$ 650.00
Reconnect Existing 30" Tile with 10 LF - 36" PVC & Rodent Guard	1	EA	\$ 1,000.00	\$ 1,000.00
Tile Discharge Slope Reinforcement Mat (9 EA)	135	SY	\$ 125.00	\$ 16,875.00
Heavy Duty Rip Rap for Culvert Discharge (4 EA)	200	SY	\$ 125.00	\$ 25,000.00
Canal Draw Down and Bypass Pumping	1	LS	\$ 25,000.00	\$ 25,000.00
Remove & Install Temporary Cofferdam @ Station 443+00, 474+00, 502+00 and 541+13	3	EA	\$ 2,800.00	\$ 8,400.00

Sub Total **\$738,598.80**
25% Contingencies **\$184,649.70**
TOTAL **\$923,248.50**

PROJECT TOTAL \$4,959,189.50

Yorkville/ Raymond District

Proposed WBRR Dredging Project Budget Costs

88.64(3)(b)

4/14/2026

West Branch of Root River

Station 0+00 (North Terminus) thru

Station 541+13 (South Terminus)

	Quantity	Unit	Unit Cost	Total
Excavation	308,645	CY	\$ 5.00	\$ 1,543,225.00
Placing and Shaping Spoil Material	308,645	CY	\$ 3.00	\$ 925,935.00
Restoration - Berm Spoils (Seed, Fertilizer, Mulch)	336,850	SY	\$ 1.00	\$ 336,850.00

Sub Total \$2,806,010.00
25% Contingencies \$701,502.50
TOTAL \$3,507,512.50

Yorkville/ Raymond District
Proposed WBRR Dredging Project Budget Costs

88.64(3)(c)

4/14/2026

West Branch of Root River
Station 0+00 (North Terminus) thru
Station 541+13 (South Terminus)

	Quantity	Unit	Unit Cost	Total
Excavation	349,530	CY	\$ 5.00	\$ 1,747,650.00
Placing and Shaping Spoil Material	349,530	CY	\$ 3.00	\$ 1,048,590.00
Restoration - Berm Spoils (Seed, Fertilizer, Mulch)	336,850	SY	\$ 1.00	\$ 336,850.00

Sub Total **\$3,133,090.00**
25% Contingencies **\$783,272.50**
TOTAL **\$3,916,362.50**

APPENDIX D
HYDROCAD MODELLING DETAILS

88.64(3)(b)

2026.0006.04 - Y-R-DD - UG LAND USE (2026)

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Page 1

Project Notes

Rainfall events imported from "NRCS-Rain.txt" for 9168 WI Kenosha

Rainfall events imported from "NRCS-Rain.txt" for 9192 WI Racine

2026.0006.04 - Y-R-DD - UG LAND USE (2026)

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Rainfall Events Listing (selected events)

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	10-Year	MSE 24-hr	3	Default	24.00	1	3.77	2

Summary for Subcatchment 4S: Area U1 - (2025-1937 Difference) (Land Use)

Runoff = 359.89 cfs @ 14.07 hrs, Volume= 99.697 af, Depth> 1.82"
 Routed to Reach 5R : Area 2 Channel

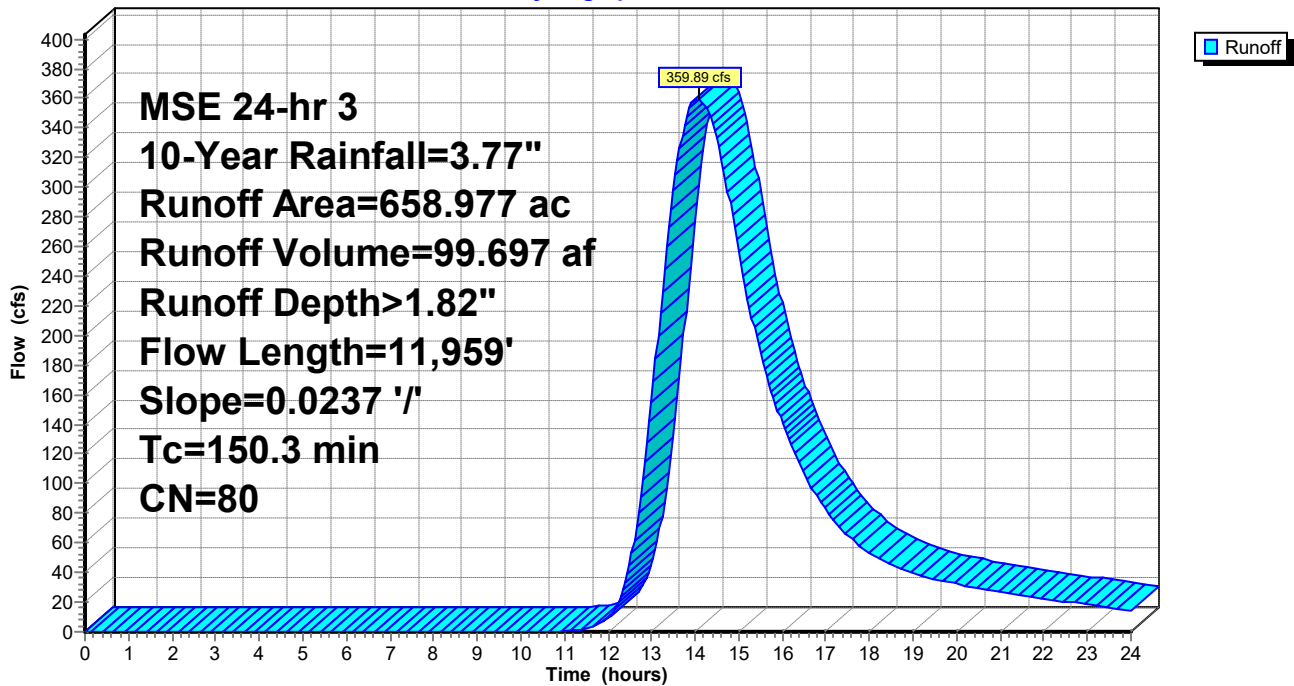
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
 MSE 24-hr 3 10-Year Rainfall=3.77"

Area (ac)	CN	Description
* 230.307	71	Ag/Park
* 133.405	92	Commercial
* 292.399	81	High Density Residential
* 2.866	77	Low Density Residential
658.977	80	Weighted Average
658.977		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
150.3	11,959	0.0237	1.33		Lag/CN Method,

Subcatchment 4S: Area U1 - (2025-1937 Difference) (Land Use)

Hydrograph



88.64(3)(c)

2026.0006.04 - Y-R-DD - UG LAND USE (2026)

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Project Notes

Rainfall events imported from "NRCS-Rain.txt" for 9168 WI Kenosha

Rainfall events imported from "NRCS-Rain.txt" for 9192 WI Racine

2026.0006.04 - Y-R-DD - UG LAND USE (2026)

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Rainfall Events Listing (selected events)

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	10-Year	MSE 24-hr	3	Default	24.00	1	3.77	2

Summary for Subcatchment 1U: Area U1 - 1937 (Land Use)

Runoff = 85.97 cfs @ 14.12 hrs, Volume= 24.524 af, Depth> 1.74"
 Routed to Reach C2 : Area 2 Channel

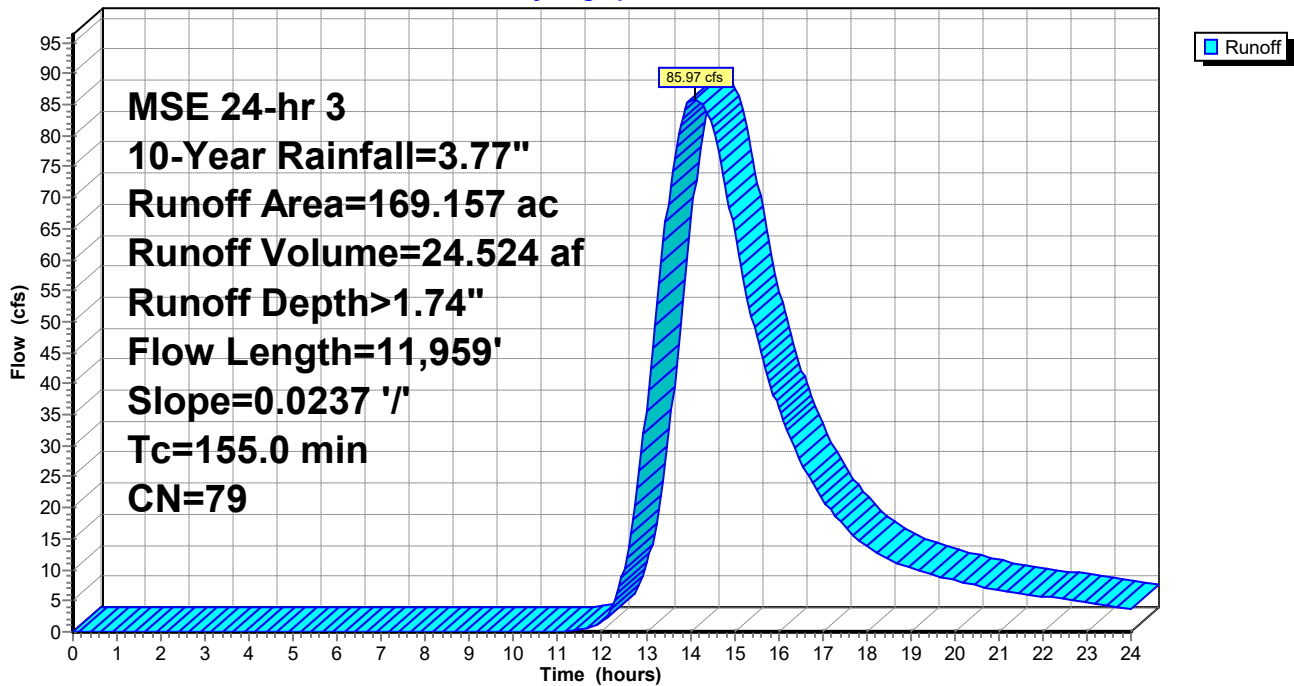
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
 MSE 24-hr 3 10-Year Rainfall=3.77"

Area (ac)	CN	Description
* 69.230	71	Ag/Park
* 35.980	92	Commercial
* 63.947	81	High Density Residential
* 0.000	77	Low Density Residential
169.157	79	Weighted Average
169.157		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
155.0	11,959	0.0237	1.29		Lag/CN Method,

Subcatchment 1U: Area U1 - 1937 (Land Use)

Hydrograph



2026.0006.04 - Y-R-DD - UG LAND USE (2026)

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Project Notes

Rainfall events imported from "NRCS-Rain.txt" for 9168 WI Kenosha

Rainfall events imported from "NRCS-Rain.txt" for 9192 WI Racine

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Rainfall Events Listing (selected events)

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	10-Year	MSE 24-hr	3	Default	24.00	1	3.77	2

Summary for Subcatchment 2S: Area U1 - 2025 (Land Use)

Runoff = 468.07 cfs @ 14.07 hrs, Volume= 129.667 af, Depth> 1.82"
 Routed to Reach 3R : Area 2 Channel

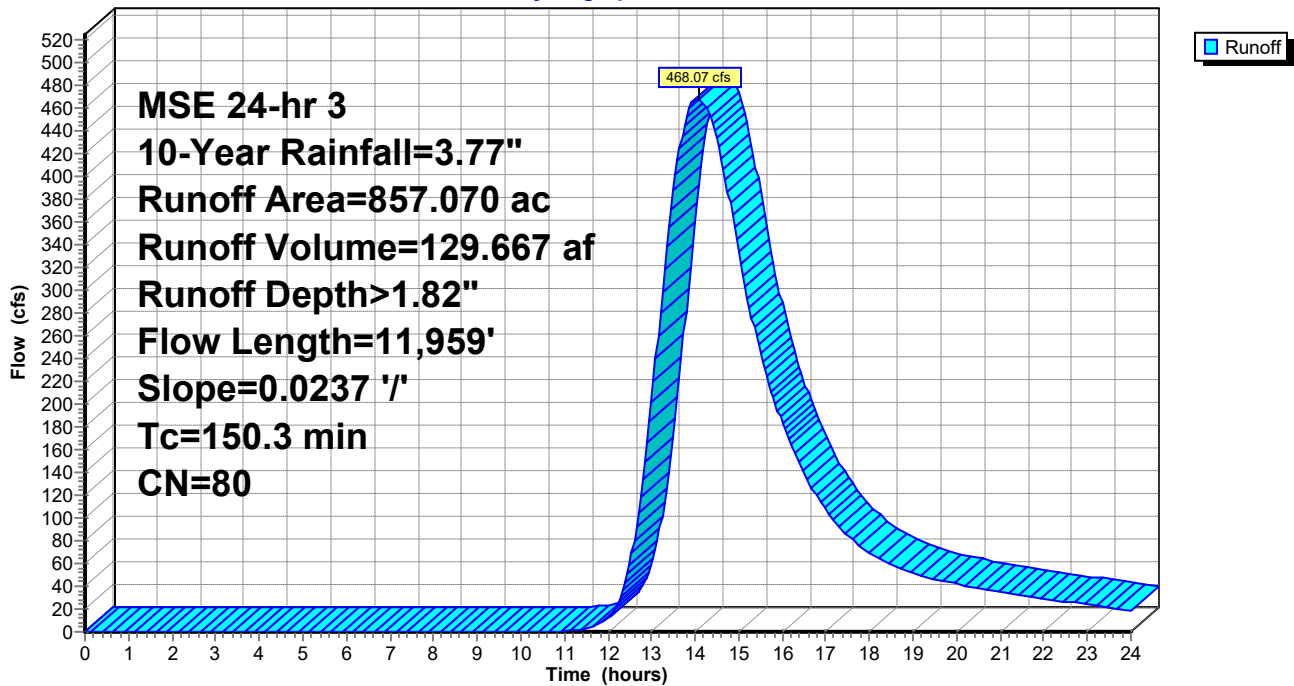
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
 MSE 24-hr 3 10-Year Rainfall=3.77"

Area (ac)	CN	Description
* 257.353	71	Ag/Park
* 180.517	92	Commercial
* 414.548	81	High Density Residential
* 4.652	77	Low Density Residential
857.070	80	Weighted Average
857.070		100.00% Pervious Area

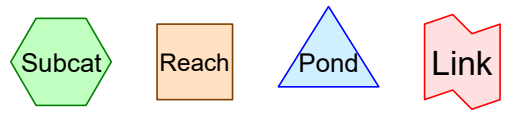
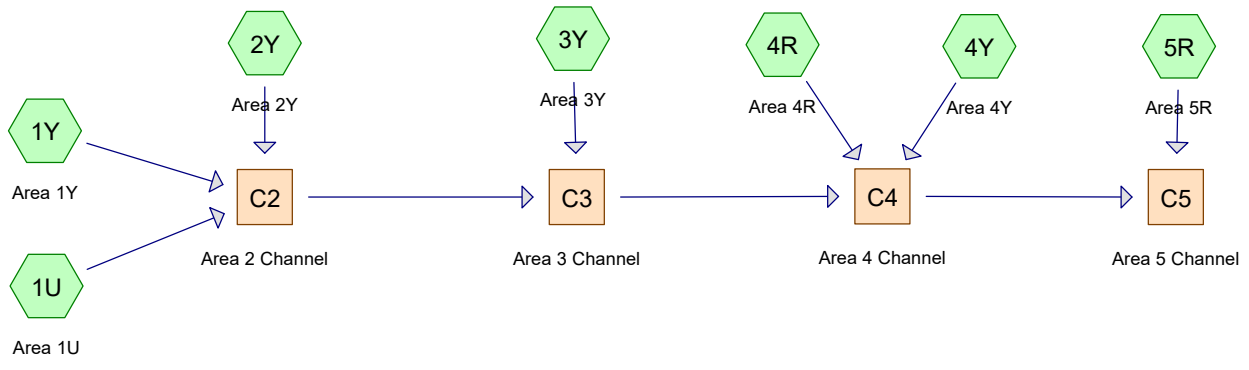
Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
150.3	11,959	0.0237	1.33		Lag/CN Method,

Subcatchment 2S: Area U1 - 2025 (Land Use)

Hydrograph



88.64(3)(e)



Routing Diagram for 2021.0006.04 Yorkville-Raymond District Drainage
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2021.0006.04 Yorkville-Raymond District Drainage

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Project Notes

Rainfall events imported from "NRCS-Rain.txt" for 9168 WI Kenosha

Rainfall events imported from "NRCS-Rain.txt" for 9192 WI Racine

2021.0006.04 Yorkville-Raymond District Drainage

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Rainfall Events Listing (selected events)

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	10-Year	MSE 24-hr	3	Default	24.00	1	3.77	2

2021.0006.04 Yorkville-Raymond District Drainage

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Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
18,353.183	71	Ag/Park (1U, 1Y, 2Y, 3Y, 4R, 4Y, 5R)
592.237	92	Commercial (1U, 1Y, 2Y, 4R, 4Y, 5R)
8.580	81	High Density Res (3Y, 5R)
387.710	81	High Density Residential (1U, 2Y, 4R, 4Y)
1,832.160	77	Low Density Res (3Y, 5R)
3,023.652	77	Low Density Residential (1U, 1Y, 4R, 4Y)
318.430	77	Low Density Residential (2Y)
365.000	81	Southern Wisconsin Center (1Y)
24,880.952	73	TOTAL AREA

2021.0006.04 Yorkville-Raymond District Drainage

MSE 24-hr 3 10-Year Rainfall=3.77"

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Time span=0.00-24.00 hrs, dt=0.05 hrs, 481 points
 Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
 Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1U: Area 1U Runoff Area=687.912 ac 0.00% Impervious Runoff Depth>1.89"
 Flow Length=11,959' Slope=0.0237 '/' Tc=145.6 min CN=81 Runoff=404.53 cfs 108.520 af

Subcatchment 1Y: Area 1Y Runoff Area=1,865.000 ac 0.00% Impervious Runoff Depth>1.42"
 Flow Length=18,118' Slope=0.0237 '/' Tc=243.3 min CN=75 Runoff=557.50 cfs 220.859 af

Subcatchment 2Y: Area 2Y Runoff Area=2,759.350 ac 0.00% Impervious Runoff Depth>1.24"
 Flow Length=13,046' Slope=0.0187 '/' Tc=229.2 min CN=72 Runoff=726.09 cfs 284.890 af

Subcatchment 3Y: Area 3Y Runoff Area=3,719.000 ac 0.00% Impervious Runoff Depth>1.26"
 Flow Length=10,035' Slope=0.0219 '/' Tc=171.7 min CN=72 Runoff=1,232.63 cfs 391.256 af

Subcatchment 4R: Area 4R Runoff Area=3,784.000 ac 0.00% Impervious Runoff Depth>1.33"
 Flow Length=9,801' Slope=0.0269 '/' Tc=147.8 min CN=73 Runoff=1,481.06 cfs 420.379 af

Subcatchment 4Y: Area 4Y Runoff Area=6,198.000 ac 0.00% Impervious Runoff Depth>1.33"
 Flow Length=9,801' Slope=0.0269 '/' Tc=147.8 min CN=73 Runoff=2,425.90 cfs 688.560 af

Subcatchment 5R: Area 5R Runoff Area=5,867.690 ac 0.00% Impervious Runoff Depth>1.25"
 Flow Length=12,077' Slope=0.0193 '/' Tc=212.1 min CN=72 Runoff=1,651.12 cfs 609.688 af

Reach C2: Area 2 Channel Avg. Flow Depth=11.44' Max Vel=1.33 fps Inflow=1,525.29 cfs 614.269 af
 n=0.040 L=10,037.4' S=0.0002 '/' Capacity=9,074.78 cfs Outflow=931.39 cfs 525.256 af

Reach C3: Area 3 Channel Avg. Flow Depth=17.50' Max Vel=1.88 fps Inflow=1,666.18 cfs 916.512 af
 n=0.040 L=10,037.4' S=0.0002 '/' Capacity=9,693.56 cfs Outflow=1,163.39 cfs 774.226 af

Reach C4: Area 4 Channel Avg. Flow Depth=12.97' Max Vel=2.43 fps Inflow=4,558.13 cfs 1,883.165 af
 n=0.040 L=9,808.0' S=0.0006 '/' Capacity=15,419.86 cfs Outflow=3,113.47 cfs 1,729.793 af

Reach C5: Area 5 Channel Avg. Flow Depth=14.96' Max Vel=2.04 fps Inflow=4,738.22 cfs 2,339.482 af
 n=0.040 L=12,084.0' S=0.0003 '/' Capacity=11,925.79 cfs Outflow=3,344.57 cfs 2,013.922 af

Total Runoff Area = 24,880.952 ac Runoff Volume = 2,724.152 af Average Runoff Depth = 1.31"
100.00% Pervious = 24,880.952 ac 0.00% Impervious = 0.000 ac

Summary for Subcatchment 1U: Area 1U

Runoff = 404.53 cfs @ 14.04 hrs, Volume= 108.520 af, Depth> 1.89"
 Routed to Reach C2 : Area 2 Channel

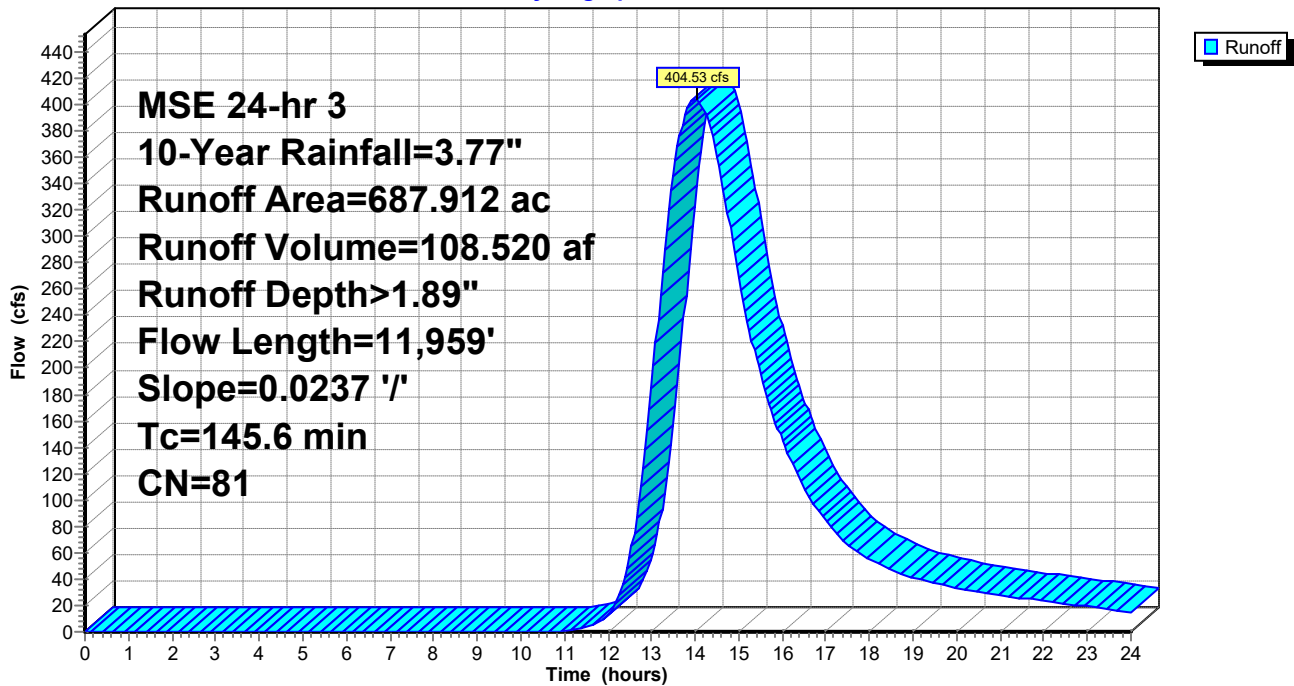
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
 MSE 24-hr 3 10-Year Rainfall=3.77"

Area (ac)	CN	Description
* 188.123	71	Ag/Park
* 144.537	92	Commercial
* 350.600	81	High Density Residential
* 4.652	77	Low Density Residential
687.912	81	Weighted Average
687.912		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
145.6	11,959	0.0237	1.37		Lag/CN Method,

Subcatchment 1U: Area 1U

Hydrograph



Summary for Subcatchment 1Y: Area 1Y

Runoff = 557.50 cfs @ 15.41 hrs, Volume= 220.859 af, Depth> 1.42"
 Routed to Reach C2 : Area 2 Channel

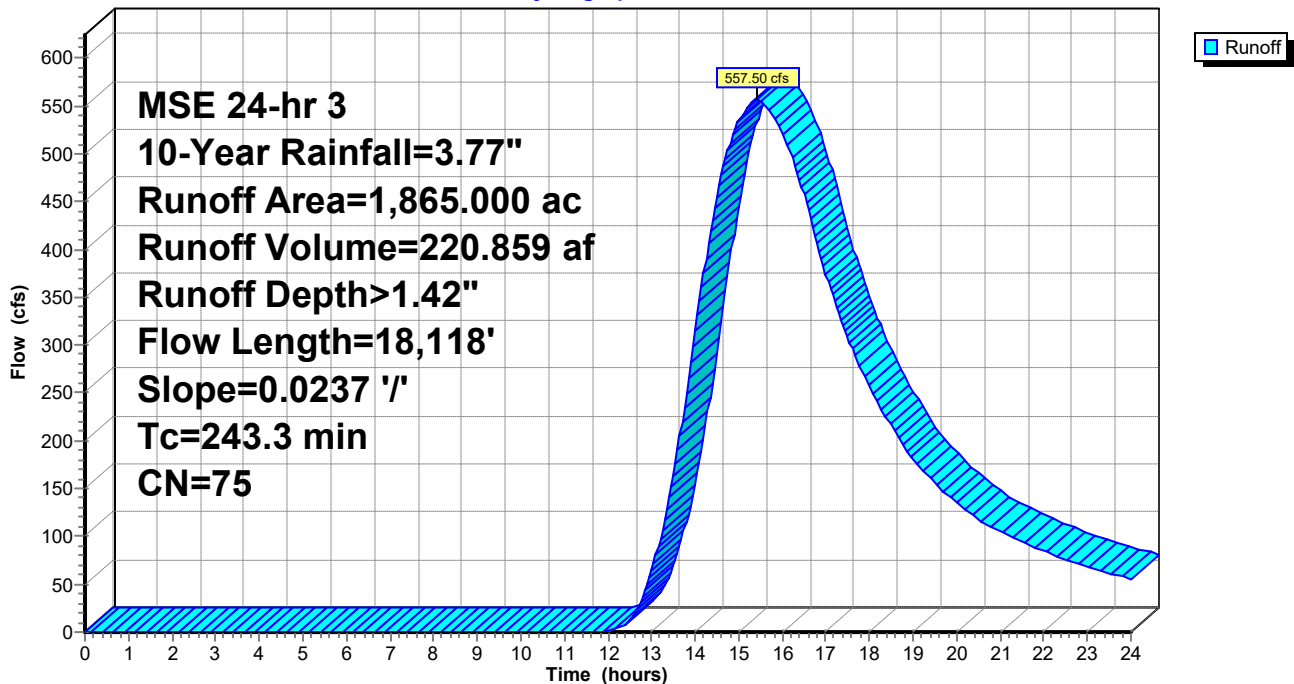
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
 MSE 24-hr 3 10-Year Rainfall=3.77"

Area (ac)	CN	Description
* 890.000	71	Ag/Park
* 11.000	92	Commercial
* 365.000	81	Southern Wisconsin Center
* 0.000	81	High Density Residential
* 599.000	77	Low Density Residential
1,865.000	75	Weighted Average
1,865.000		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
243.3	18,118	0.0237	1.24		Lag/CN Method,

Subcatchment 1Y: Area 1Y

Hydrograph



Summary for Subcatchment 2Y: Area 2Y

Runoff = 726.09 cfs @ 15.05 hrs, Volume= 284.890 af, Depth> 1.24"
 Routed to Reach C2 : Area 2 Channel

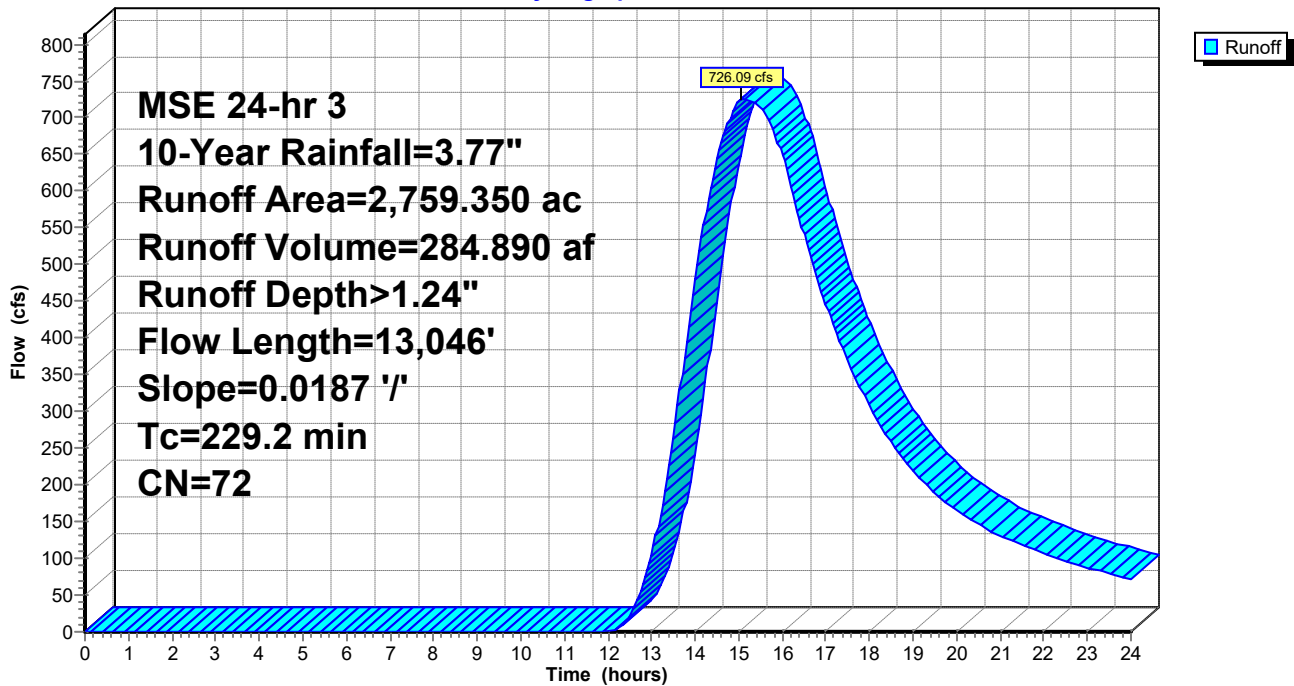
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
 MSE 24-hr 3 10-Year Rainfall=3.77"

Area (ac)	CN	Description
* 2,366.140	71	Ag/Park
* 73.670	92	Commercial
* 1.110	81	High Density Residential
* 318.430	77	Low Desnity Residential
2,759.350	72	Weighted Average
2,759.350		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
229.2	13,046	0.0187	0.95		Lag/CN Method,

Subcatchment 2Y: Area 2Y

Hydrograph



Summary for Subcatchment 3Y: Area 3Y

Runoff = 1,232.63 cfs @ 14.36 hrs, Volume= 391.256 af, Depth> 1.26"
 Routed to Reach C3 : Area 3 Channel

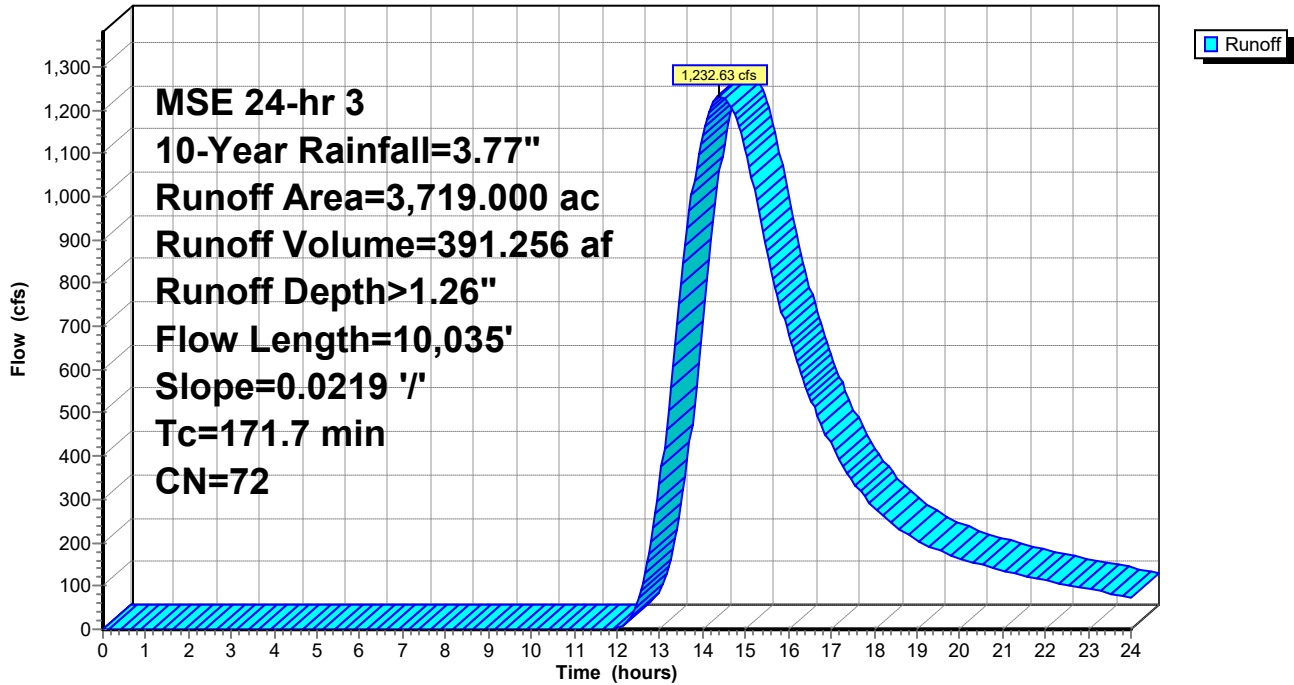
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
 MSE 24-hr 3 10-Year Rainfall=3.77"

Area (ac)	CN	Description
* 3,203.180	71	Ag/Park
* 0.370	81	High Density Res
* 515.450	77	Low Density Res
3,719.000	72	Weighted Average
3,719.000		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
171.7	10,035	0.0219	0.97		Lag/CN Method,

Subcatchment 3Y: Area 3Y

Hydrograph



Summary for Subcatchment 4R: Area 4R

Runoff = 1,481.06 cfs @ 14.00 hrs, Volume= 420.379 af, Depth> 1.33"
 Routed to Reach C4 : Area 4 Channel

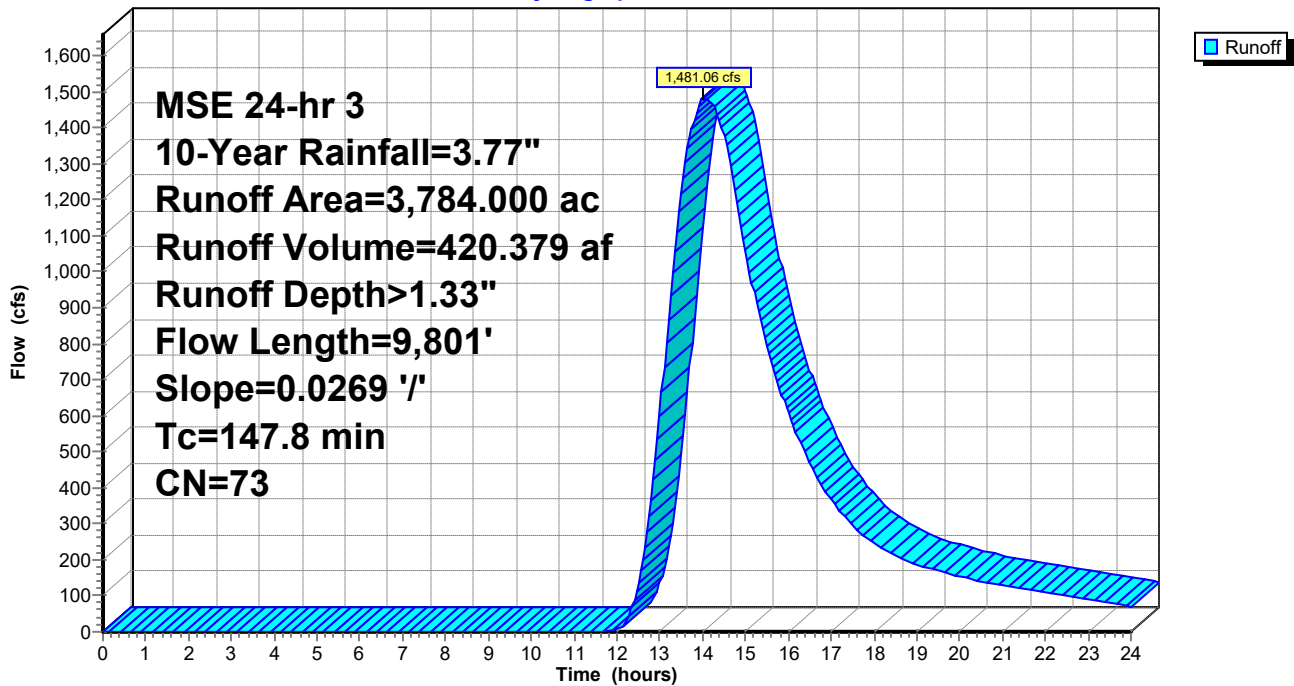
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
 MSE 24-hr 3 10-Year Rainfall=3.77"

Area (ac)	CN	Description
* 2,732.000	71	Ag/Park
* 8.000	92	Commercial
* 1.000	81	High Density Residential
* 1,043.000	77	Low Density Residential
3,784.000	73	Weighted Average
3,784.000		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
147.8	9,801	0.0269	1.10		Lag/CN Method,

Subcatchment 4R: Area 4R

Hydrograph



Summary for Subcatchment 4Y: Area 4Y

Runoff = 2,425.90 cfs @ 14.00 hrs, Volume= 688.560 af, Depth> 1.33"
 Routed to Reach C4 : Area 4 Channel

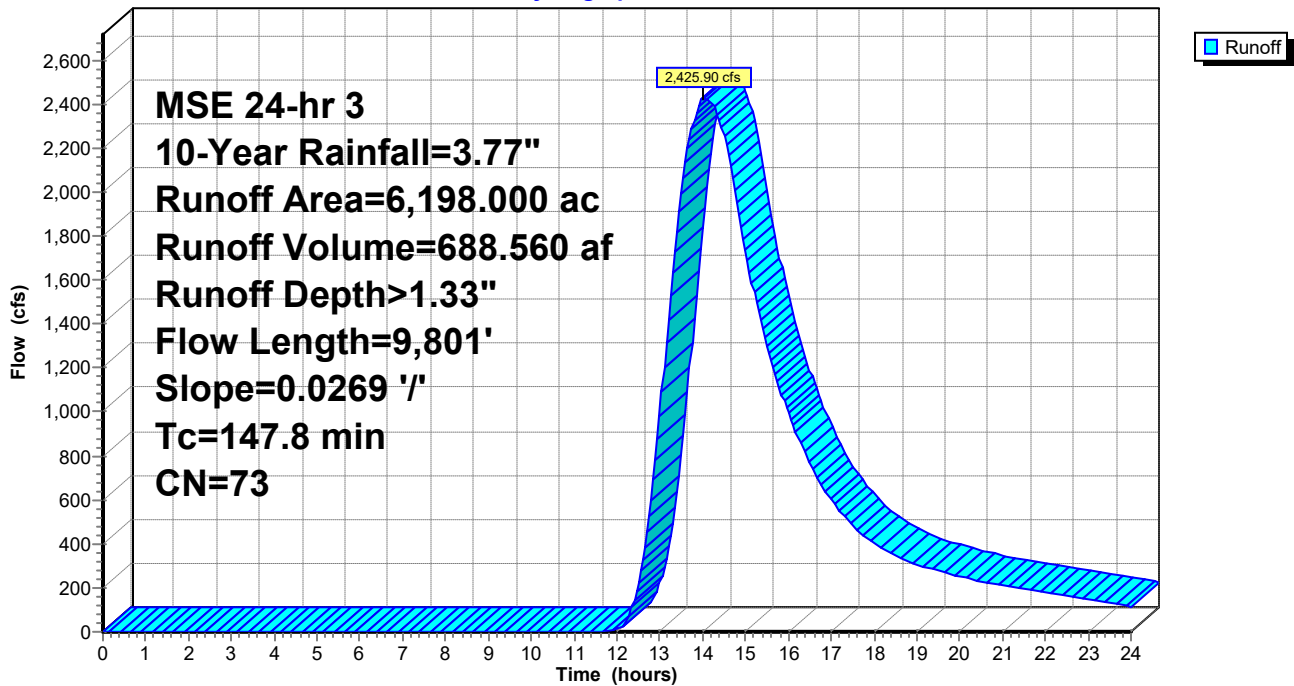
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
 MSE 24-hr 3 10-Year Rainfall=3.77"

Area (ac)	CN	Description
* 4,465.000	71	Ag/Park
* 321.000	92	Commercial
* 35.000	81	High Density Residential
* 1,377.000	77	Low Density Residential
6,198.000	73	Weighted Average
6,198.000		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
147.8	9,801	0.0269	1.10		Lag/CN Method,

Subcatchment 4Y: Area 4Y

Hydrograph



Summary for Subcatchment 5R: Area 5R

Runoff = 1,651.12 cfs @ 14.87 hrs, Volume= 609.688 af, Depth> 1.25"
 Routed to Reach C5 : Area 5 Channel

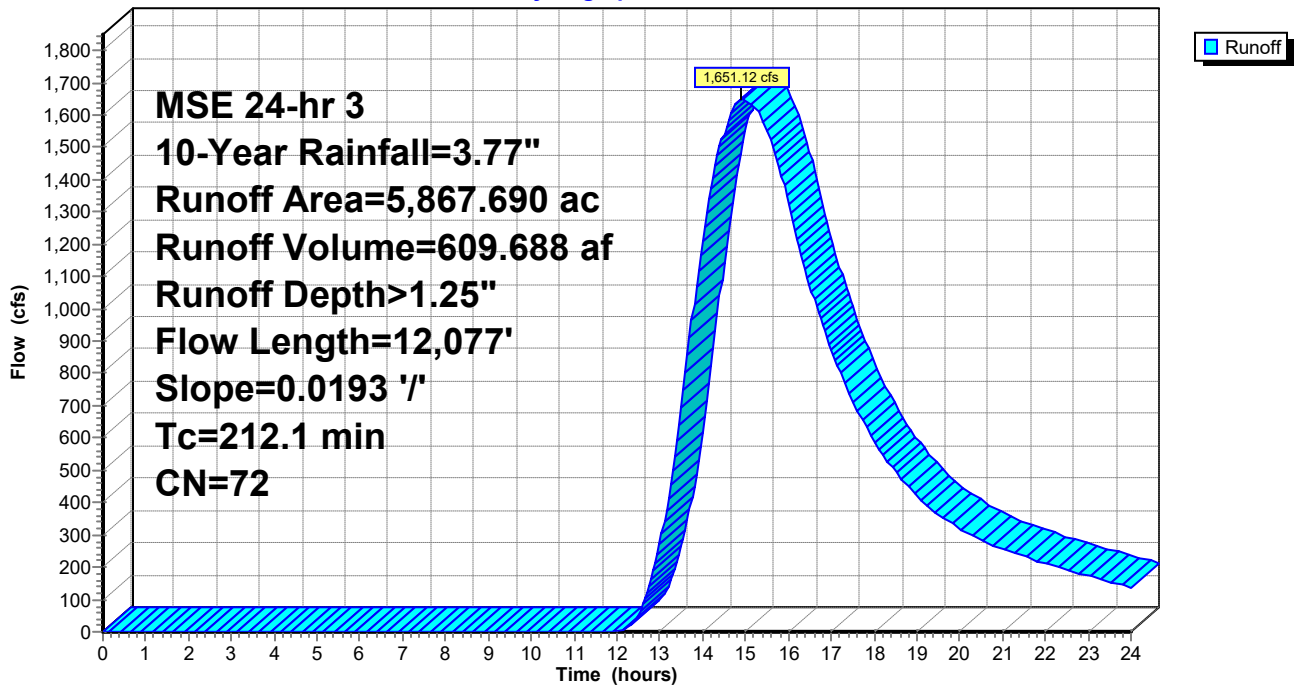
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
 MSE 24-hr 3 10-Year Rainfall=3.77"

Area (ac)	CN	Description
* 4,508.740	71	Ag/Park
* 34.030	92	Commercial
* 8.210	81	High Density Res
* 1,316.710	77	Low Density Res
5,867.690	72	Weighted Average
5,867.690		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
212.1	12,077	0.0193	0.95		Lag/CN Method,

Subcatchment 5R: Area 5R

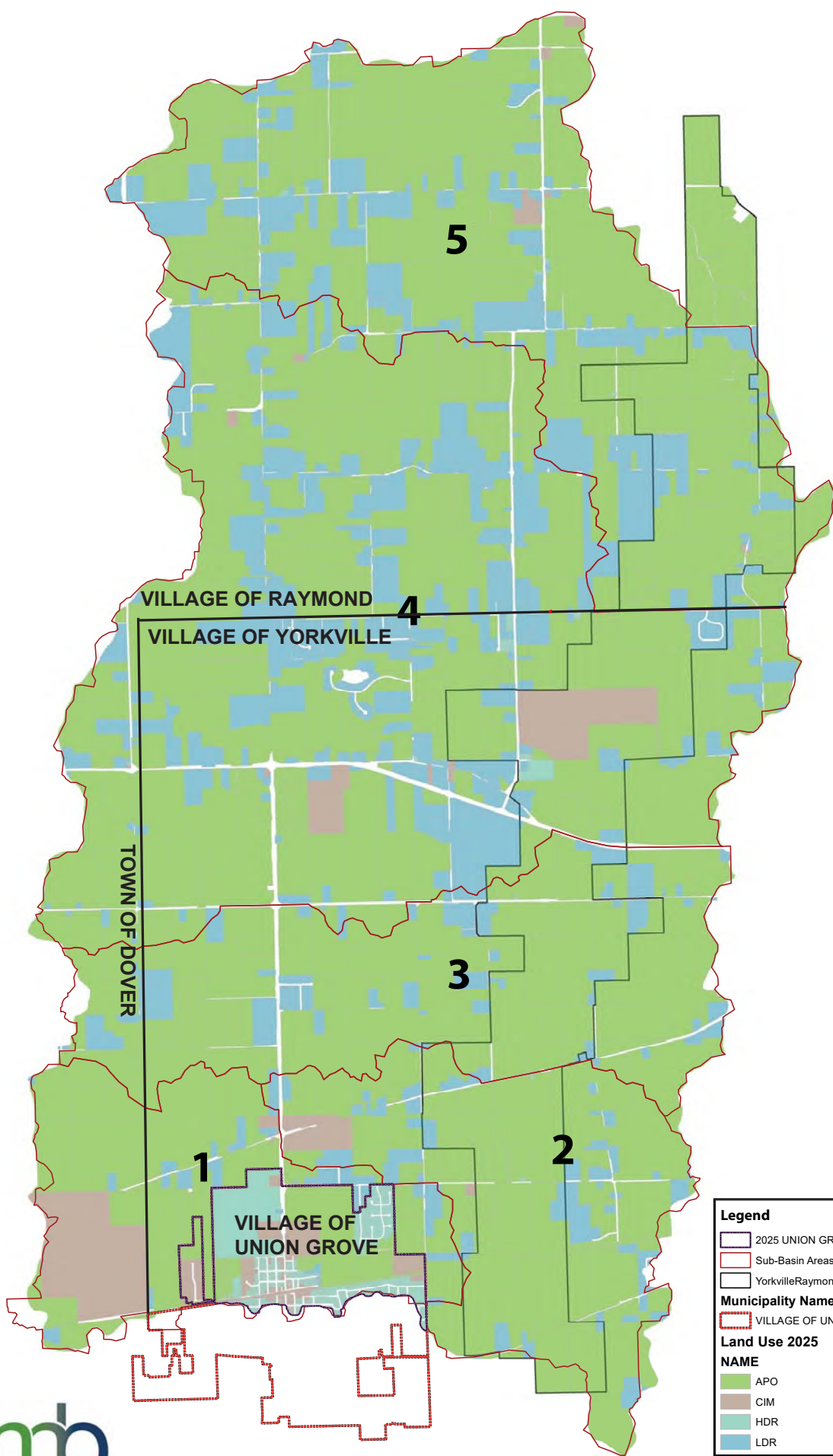
Hydrograph



APPENDIX E
ANNUAL EFFLUENT DATA
THE UNION GROVE SEWER UTILITY TREATMENT PLANT

Month	Effluent Flow MGD	Month	Effluent Flow MGD	Month	Effluent Flow MGD	Month	Effluent Flow MGD	Month	Effluent Flow MGD
Jan-16	37.881	Jan-17	34.684	Jan-18	21.142	Jan-19	33.339	Jan-20	37.535
Feb-16	33.458	Feb-17	26.300	Feb-18	30.270	Feb-19	46.589	Feb-20	30.566
Mar-16	41.566	Mar-17	45.118	Mar-18	28.226	Mar-19	43.355	Mar-20	46.688
Apr-16	39.469	Apr-17	52.228	Apr-18	35.057	Apr-19	37.452	Apr-20	39.724
May-16	32.109	May-17	40.584	May-18	48.617	May-19	54.980	May-20	53.220
Jun-16	26.232	Jun-17	30.652	Jun-18	44.563	Jun-19	36.520	Jun-20	27.821
Jul-16	22.047	Jul-17	49.554	Jul-18	27.474	Jul-19	33.425	Jul-20	30.131
Aug-16	25.140	Aug-17	20.557	Aug-18	29.507	Aug-19	29.904	Aug-20	29.603
Sep-16	25.233	Sep-17	15.985	Sep-18	38.517	Sep-19	40.192	Sep-20	23.926
Oct-16	28.958	Oct-17	24.952	Oct-18	50.893	Oct-19	53.730	Oct-20	24.858
Nov-16	26.666	Nov-17	22.071	Nov-18	36.517	Nov-19	39.703	Nov-20	25.519
Dec-16	34.624	Dec-17	16.859	Dec-18	40.958	Dec-19	35.278	Dec-20	29.174
Minimum	22.047	Minimum	15.985	Minimum	21.142	Minimum	29.904	Minimum	23.926
Maximum	41.566	Maximum	52.228	Maximum	50.893	Maximum	54.980	Maximum	53.220
Total	373.383	Total	379.544	Total	431.741	Total	484.467	Total	398.765
Average	31.115	Average	31.629	Average	35.978	Average	40.372	Average	33.230
Month	Effluent Flow MGD	Month	Effluent Flow MGD	Month	Effluent Flow MGD	Month	Effluent Flow MGD	Month	Effluent Flow MGD
Jan-21	-	Jan-22	20.459	Jan-23	29.604	Jan-24	44.596	Jan-25	18.441
Feb-21	24.111	Feb-22	22.750	Feb-23	44.930	Feb-24	36.463	Feb-25	16.870
Mar-21	45.266	Mar-22	36.133	Mar-23	55.195	Mar-24	50.909	Mar-25	33.646
Apr-21	27.484	Apr-22	53.665	Apr-23	42.397	Apr-24	53.413	Apr-25	31.993
May-21	21.706	May-22	41.095	May-23	30.390	May-24	45.586	May-25	27.070
Jun-21	21.836	Jun-22	24.148	Jun-23	23.524	Jun-24	37.852	Jun-25	25.246
Jul-21	20.807	Jul-22	23.514	Jul-23	25.751	Jul-24	34.348	Jul-25	26.706
Aug-21	23.326	Aug-22	23.610	Aug-23	25.273	Aug-24	19.197	Aug-25	20.682
Sep-21	18.848	Sep-22	27.740	Sep-23	25.887	Sep-24	16.780	Sep-25	18.038
Oct-21	20.563	Oct-22	22.998	Oct-23	26.651	Oct-24	18.306	Oct-25	17.357
Nov-21	18.974	Nov-22	23.193	Nov-23	25.483	Nov-24	24.578	Nov-25	15.947
Dec-21	23.391	Dec-22	26.917	Dec-23	32.773	Dec-24	20.362	Dec-25	21.295
Minimum	18.848	Minimum	20.459	Minimum	23.524	Minimum	16.780	Minimum	15.947
Maximum	45.266	Maximum	53.665	Maximum	55.195	Maximum	53.413	Maximum	33.646
Total	266.312	Total	346.222	Total	387.858	Total	402.390	Total	273.291
Average	24.210	Average	28.852	Average	32.322	Average	33.533	Average	22.774

APPENDIX F
OVERALL DRAINAGE BOUNDARY



TOWN OF DOVER

VILLAGE OF RAYMOND
VILLAGE OF YORKVILLE

VILLAGE OF UNION GROVE

Legend

- 2025 UNION GROVE AREA
- Sub-Basin Areas
- YorkvilleRaymondDrainBoundary

Municipality Name

- VILLAGE OF UNION GROVE

Land Use 2025

NAME

- APO
- CIM
- HDR
- LDR



APPENDIX G
MAINTENANCE COSTS

RACINE COUNTY BOARD DRAINAGE COMMISSIONERS

YORKVILLE-RAYMOND DISTRICT

UNION GROVE ASSESSMENT BUDGET COSTS

(5-18-2026)

Proposed West Branch Root River Canal Project

Spraying

Tree/Brush (estimate)	\$43,500
Broadleaf Contract (estimate)	<u>\$2,400</u>
Spraying Sub-Total	\$45,900

Corridor Bank Mowing

Mowing -10.3 miles (estimate)	<u>\$28,900</u>
Mowing Sub-Total	\$28,900

West Branch Root River Canal Maintenance Project (estimates)

Contract #1 - North Terminus to CTH "K" (1.73 miles)	\$1,101,800
Contract #2 – CTH "K" to 2 Mile Road (2.28 miles)	\$1,468,000
Contract #3 – 2 Mile Road to STH "20" (1.86 miles)	\$833,600
Contract #4 – STH "20" to CTH "C" (1.90 miles)	\$632,600
Contract #5 – CTH "C" to South Terminus (2.47 miles)	\$923,200
Engineering (plans/bid/inspection/construction management)	<u>\$220,000</u>
WBRR Canal Maintenance Sub-Total	\$5,179,200

Yearly District Operational Costs

Operational Costs (average of past 5 years)	<u>\$120,000</u>
Operational Costs Sub-Total	\$120,000
Total West Branch Root River Canal Maintenance Costs	\$5,374,000

2023 Assessment Yorkville-Raymond District Report (Prorated to 35.8% Share)

Engineering Assessment Report	\$7,693
Legal and Administrative	<u>\$17,900</u>
2023 Assessment Report Sub-Total	\$25,593

2026 Union Grove Assessment Report

Engineering Assessment Report	\$60,000
Legal and Administrative	<u>\$78,000</u>
2026 Assessment Report Sub-Total	\$138,000

WBRR Canal Maintenance & Operational Costs (Prorated to 35.8% Share)

Spraying, Mowing, Maintenance Project & District Operational	<u>\$1,923,892</u>
Maintenance & Operational Sub-Total	\$1,923,892

Total Union Grove Maintenance Costs \$2,087,485

APPENDIX H
Section 88.64(3)(b) & 88.64(3)(c)
Land Use Exhibits

Tuesday, April 14, 2026 9:12:13 AM

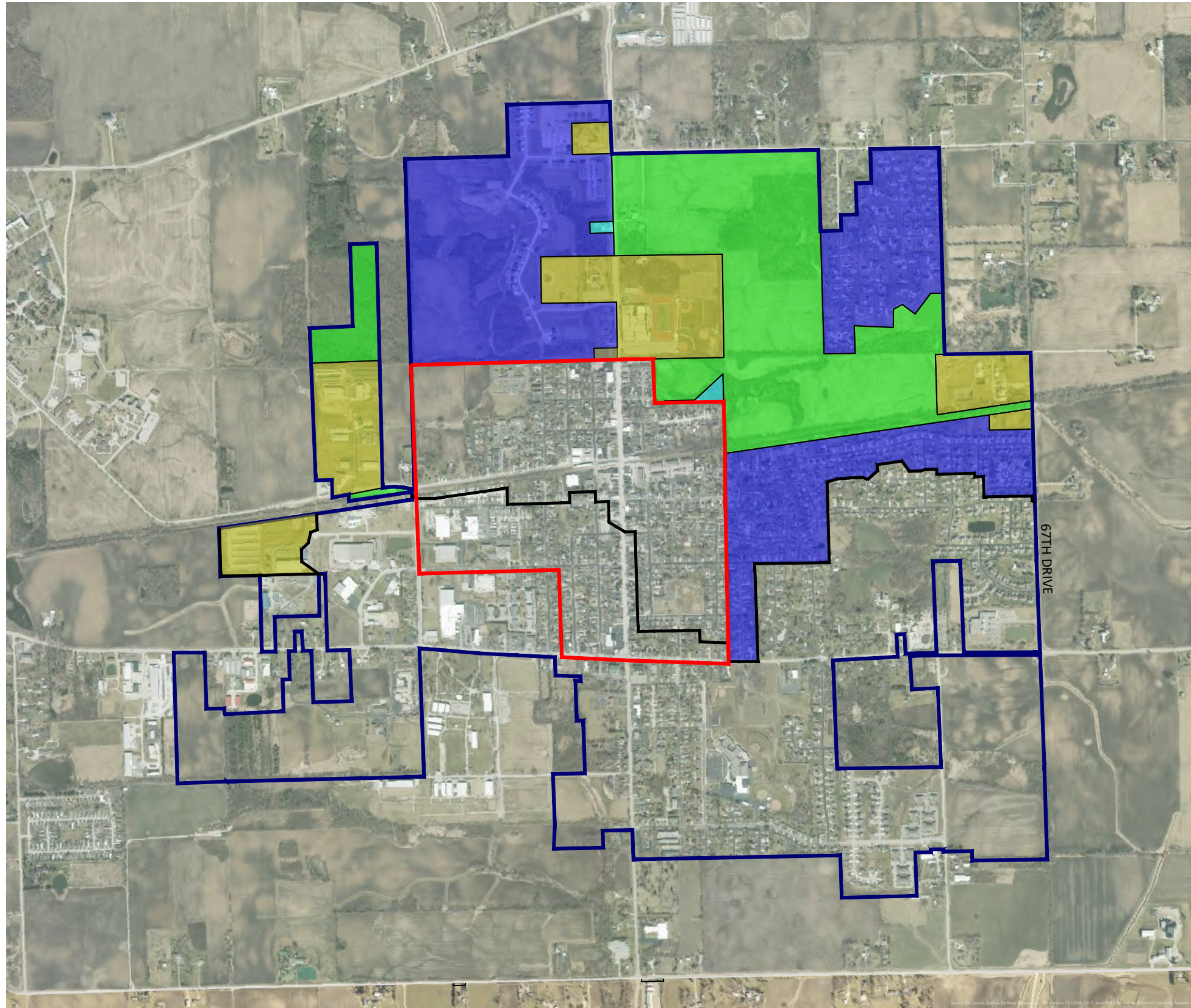


Exhibit 88.64(3)(b)

LEGEND

LAND USE 2025

- APO
- CIM
- HDR
- LDR
- 1908 UG BOUNDARY
- 2025 UG BOUNDARY
- WATERSHED BOUNDARY

Scale: 1" = 1500'

Drawn By: JWR

DATE: 4-14-2026

2026.0006.04

Exhibit 88.64(3)(b)

YORKVILLE - RAYMOND

DRAINAGE DISTRICT

Racine County, Wisconsin



Nielsen Madsen + Barber

CIVIL ENGINEERS AND LAND SURVEYORS

1458 Horizon Blvd. Suite 200, Racine, WI. 53406

Tele: (262)634-5588 Website: www.nmbosc.net

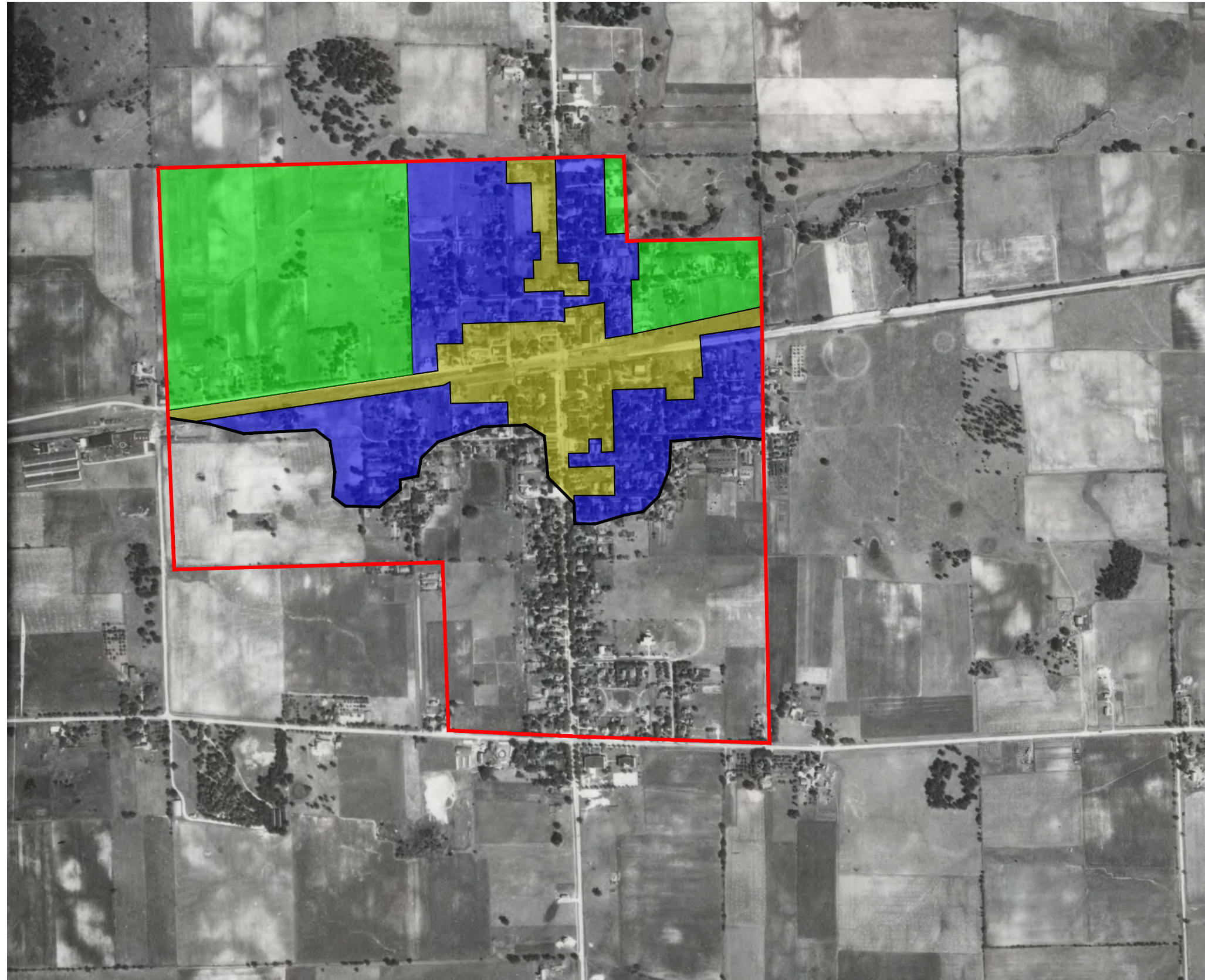


Exhibit 88.64(3)(c)-1

LEGEND

LAND USE 1937

- APO
- CIM
- HDR
- LDR

- 1908 UG BOUNDARY
- WATERSHED BOUNDARY

Scale: 1" = 750'
 Drawn By: JWR
 DATE: 4-14-2026
 2026.0006.04

Exhibit 88.64(3)(c) - 1
 YORKVILLE - RAYMOND
 DRAINAGE DISTRICT
 Racine County, Wisconsin

8:49:12 AM

Tuesday, April 14, 2026



Nielsen Madsen + Barber
 CIVIL ENGINEERS AND LAND SURVEYORS
 1458 Horizon Blvd. Suite 200, Racine, WI. 53406
 Tele: (262)634-5588 Website: www.nmbosc.net

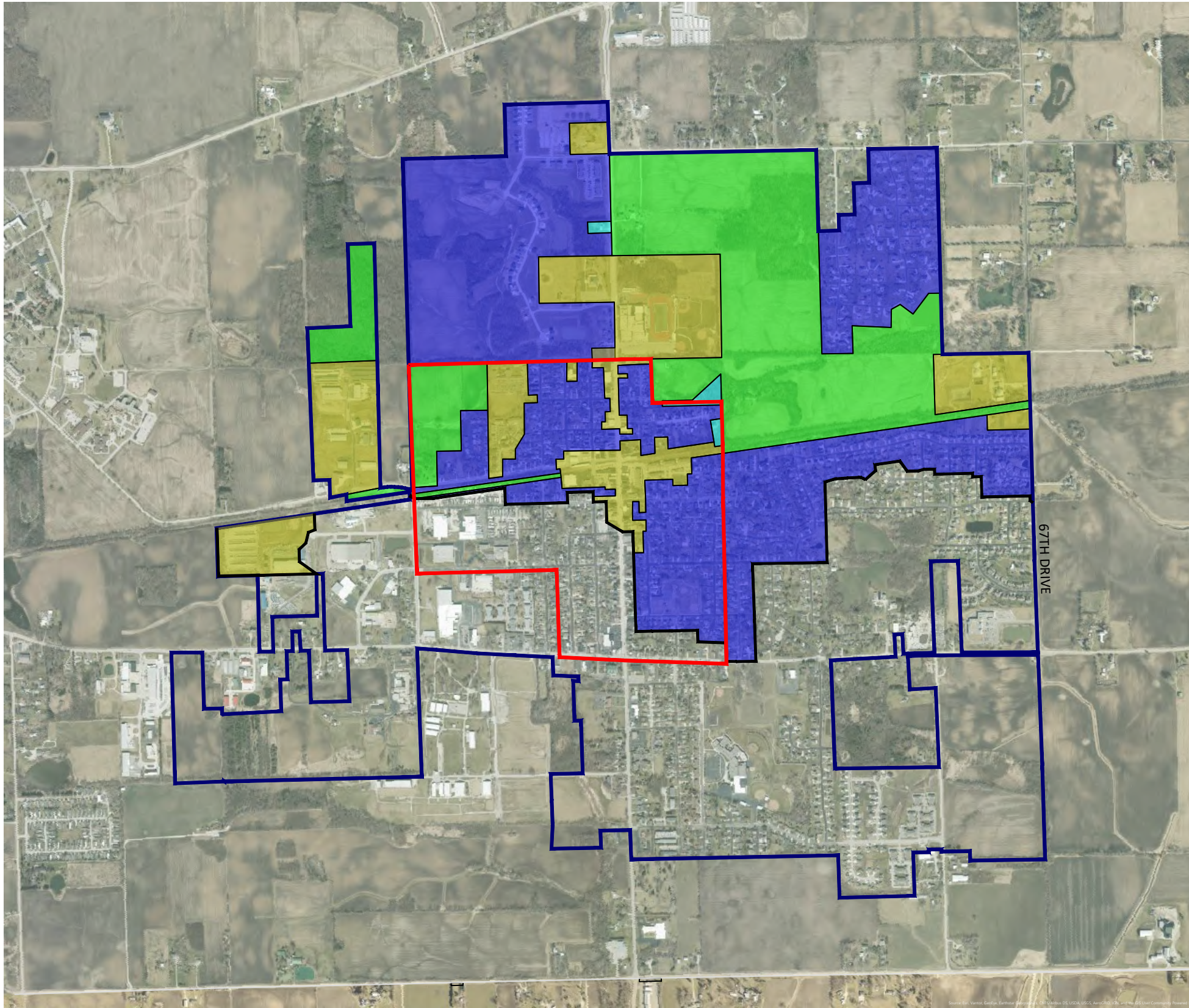


Exhibit 88.64(3)(c)-2

LEGEND

LAND USE 2025

- APO
- CIM
- HDR
- LDR
- 1908 UG BOUNDARY
- 2025 UG BOUNDARY
- WATERSHED BOUNDARY

Scale: 1" = 1500'
 Drawn By: JWR
 DATE: 4-14-2026
 2026.0006.04

Exhibit 88.64(3)(c) - 2
 YORKVILLE - RAYMOND
 DRAINAGE DISTRICT
 Racine County, Wisconsin

9:03:37 AM

Tuesday, April 14, 2026



Nielsen Madsen + Barber
 CIVIL ENGINEERS AND LAND SURVEYORS
 1458 Horizon Blvd. Suite 200, Racine, WI. 53406
 Tele: (262)634-5588 Website: www.nmbosc.net